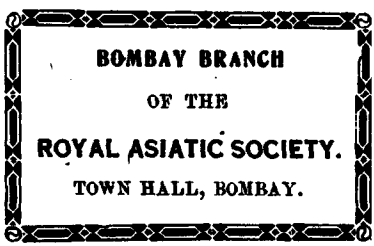
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PRESENTATION

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AN

INTRODUCTION

TO

THE MODERN CLASSIFICATION

OF

INSECTS;

FOUNDED ON

THE NATURAL HABITS AND CORRESPONDING ORGANISATION

OF

THE DIFFERENT FAMILIES.

By J. O. WESTWOOD, F.L.S.

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"Empirici, *formicæ* more, congerunt tantum et utuntur: rationales, *aranearum* more, telas ex se conficiunt: *apis* vero ratio media est, quæ materiam ex floribus horti et agri elicit; sed tamen eam propria facultate vertit et digerit."—Bacon, *Nov. Org.* lib. i. aph. 95.

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PREFACE.

THE majority of Entomological Works which have appeared, during the last quarter of a century, and which have not only given so great an impulse to the science, but have also imparted to it a philosophical character, of which it was previously destitute, may be described as exhibiting either generalised views of the subject; or, of elaborate technical details of the genera and species of insects.

Thus, whilst the delightful *Introduction to Entomology* of Messrs. Kirby and Spence, followed by Burmeister's *Manual*, and, at more humble distances, by the *Insect Architecture*, *Transformations and Miscellanies*, the *Grammar of Entomology*, by Newman, and my *Entomologist's Text-Book*, have made us acquainted with the general details of insect habits and structure; the *Illustrations and Descriptions of the Genera of British Insects* of Curtis, the *Illustrations of British Entomology* of Stephens, the *Essay on the Fossorial Hymenoptera* of Shuckard, the *Lepidoptera Britannica* of Haworth, &c., have led us to the investigation of the minute details of generic and specific distinctions. The nature of these works necessarily rendered them essentially different in the information they conveyed; indeed, owing to the greater number of organs possessed by insects over the higher animals, and the consequently great modifications to which they are subjected in the different groups, in order to fit them for performing their various functions, it must be evident that the former class of works, unless extended to a great number of volumes, must necessarily exclude the description

of genera and species; whilst the immense number of insect species in like manner prevented the latter class of works from entering into detailed accounts of habits and structure, or inquiries into the relations of the different groups.

Thus the student was led at once from the *general views* he had gained of the subject, to the minute technical details of *genera* and *species*, there being no work which he could take up to serve as a guide to the developement of the principles of modern classification, in the distribution of the *orders* and *families*. For years this deficiency has strikingly manifested itself to me, and it is long since I announced my present undertaking, in which I had proposed to myself to show the application of the modern views which have been entertained relative to the natural relations of animals in the arrangement of the entire groups of winged insects; illustrating the subject by details of the natural habits, transformations, and structure of the different families.

Nothing can be more distinct than the views entertained by Linnæus and his immediate followers, and modern naturalists, as to the principles of classification. With the former, nothing further was requisite than the construction of an arrangement by which the name of a species might be arrived at in the most convenient, and, consequently, often in the most artificial, manner. Totally regardless of the relations, more or less remote, existing amongst the different groups, their writings cannot be regarded otherwise, than as *catalogues raisonnées*. Modern entomologists, on the other hand, with Latreille at their head, have endeavoured to render the science more in accordance with nature by the establishment of "*Familles Naturelles*" for the reception of the species most nearly according in habits and structure, the investigation of which, in all the various states of the insects' existence, has been rendered requisite, in order to trace the limits, or to show the points of connexion existing between the different groups. Convinced that in our endeavours to perfect

this *modern classification* of insects, we should deserve the greatest assistance from an acquaintance with their preparatory states, I have, during sixteen years of attentive observation, constantly kept that object in view, carefully noting down with pen and pencil every fact which seemed to bear upon the subject. I have studied nature in the woods and fields, tending and observing insects in all their various transformations, well knowing, that the man who confines his researches to the mere collection and examination of museum specimens, can neither possess so intellectual an enjoyment, nor acquire so perfect a knowledge of the subject, as is to be derived from the examination of living nature; and it is both with pleasure and with pride that I now submit the results of my numerous observations to the reader.

Another object, which strongly impressed itself upon my attention, was the necessity for a careful examination and arrangement of the facts scattered throughout the voluminous transactions of foreign and native societies, and the various zoological and entomological magazines and other repertoria of science. The time occupied in wading through the hundreds of volumes which this investigation has necessitated, has been immense; but the value of the observations otherwise left to slumber unnoticed, will speak for itself. Independent of the materials thus obtained and alluded to in the body of the work, the "Bibliographical Notices" attached to each family, cannot but be of infinite service to the student.

It is not, however, to my own materials, and those derived from published works alone, that I have had recourse. I have industriously availed myself of every opportunity of studying the collections, as well in great Britain as in France and Germany; and I must take the present opportunity of returning my sincere thanks to all my friends who have assisted me in my undertaking, and whose communications I have punctually noticed in the body of my work; but more especially to M.

Victor Audouin, professor of entomology at the Jardin des Plantes, who has kindly permitted me to make unlimited use of his unique collection and voluminous manuscripts relative to the economy of insects in completing my present work.

I have commenced the work with general observations on insects, and then proceeded to divide them into orders: I have afterwards taken up each order separately, dividing it into families, and giving an account of the characters, habits, transformations, and general distribution of the insects comprised within each family, with an illustration of their characteristic anatomical details and preparatory states.

It is thus that I have endeavoured to make my work a fitting "Sequel" to the *Introduction to Entomology* of Messrs. Kirby and Spence, who, upon being made acquainted with its nature, kindly sanctioned my thus styling it. That it may be deemed worthy of such a title, and of a place by the side of their volumes, is the highest object of my ambition.

At the same time, in order that this work may serve as a precursor to the works of Curtis, Stephens, &c., I have added a synopsis of the British genera, brought down to the present time. The idea of the addition of this synopsis was derived from Latreille's *Considérations Générales*, in which the genera are shortly characterised, and the names of the typical species given in an Appendix. The additions of generic synonymes, references to generic figures and indications of the number of British species, will render the synopsis more complete, although it must be evident that it can serve but as a guide to more extended research.

The numerous figures with which the work is illustrated are, in almost every instance, original, and drawn by myself.

I cannot conclude this preface without alluding to the endless

gratification to be derived from the study of this branch of natural history, of which the present work bears such ample testimony. For a long series of years, the collection of materials for its completion has been a ceaseless labour of love. Indeed, had it not been thus, it would have been impossible for me to have proceeded in an undertaking "of which the profit, if by great chance there should be any, could not be expected to repay, even the cost of books required in it, and from which any fame must necessarily be confined to a very limited circle*," and in which the time absorbed in the preparation of the text, and in microscopically dissecting so many minute objects represented in the wood-cuts, has been so great. I have, however, persevered, and, if I shall have succeeded in inducing any of my readers to pursue the science with a higher aim than that of collecting specimens, by investigating the habits and the corresponding organisation of these animals with a view to the discovery of their natural relations and classification, my labours will not have been in vain.

* Kirby and Spence, Introd. pref. vol. i. p. 10.

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ERRATA AND ADDENDA TO VOL. I.

Page 1. line 8. for "and antennæ" read "and two antennæ."
line 11. after "Aristotle" read "and the class of insects of Lamarck."
3. line 5. for "mites" read "lice."
In reference to the observations in sect. 1. relative to the importance of metamorphosis as the leading character of the Ptilota, Mr. MacLeay, in consequence of the observations of Mr. J. V. Thompson, and the confirmation assumed to have been afforded to them by the recent researches of Captain Ducane (*Annals Nat. Hist.* No. 9. Nov. 1838.) has suggested the theory, that "the Ptilota may be characterised by their change of form taking place during their last two or three stages of ecdysis; while the metamorphosis of all other annulosa only occurs during the first or second moult after leaving the egg." (*Illustr. Zool. So. Africa*, No. 3. p. 53.) In opposition to this theory, I will only here reply that the most elaborate examinations hitherto made of the eggs of spiders and crustacea by Heroldt and Rathke, together with my own of the egg of one of West Indian Land Crabs, have clearly demonstrated that, at least in the species under examination, not the slightest change worthy of the name of metamorphosis takes place.
11. line 16. for "in insects" read "in those insects."
line 18. for "being" read "are."
line 20. dele.
line 30. for "are as destitute" read "which are as destitute."
16. line 3. for "oxyginating" read "oxygenating."
17. line 10. 29. for "Homomorphous" read "Monomorphous."
line 19. for "larvæ" read "larva."
21. line 21. dele "and" before Dermaptera.
32. line 44. for "Harris in ditto?" read "Harris in *Nat. Hist. Soc. Hartford*, vol. i."
37. line 37. Mr. Haliday states in the *Zoological Journal*, that Clambus possesses five joints in the tarsi.
42. line 40. for "Philyhdrida" read "Philhydrida."
83. line 14. Mr. Newman assures me that Eutoma tinctilatus possess a maxillary unguis, which escaped my microscopical examination of it. If this be the case, it cannot enter into the genus Carenum, in which Latreille noticed the want of a maxillary hook. (*R. An.* second edition, tom. iv. p. 381.)
89. line 30. for "Chychrus" read "Cychrus."
93. The elaborate volume of descriptions of Dyticidæ and Gyrinidæ recently published by M. Aubé, must be particularly noticed.
118. line 9. for "to be the" read "to be those of the."
123. note *, line 2. for "species" read "spaces."
126. note †, M. Audouin has published a note upon this subject in the *Hist. Nat. Ins.* tom. v. p. 268.

Page 151. Mr. MacLeay states that his brother has observed that an Australian species of Cerapterus resides in ants' nests, and likewise possesses the power of crepitating.

152. note *, for "Mycelophagidæ" read "Mycetophagidæ."

176. note *, Within a month from the time of the publication of this note (namely, on the 30th of August, 1838), I had the pleasure to capture the Claviger foveolatus in an ant's nest in Whychwood Forest, Oxfordshire.

183. note †, read "*Faun. Boreal. Americana.*"

220. line 30. and 31. dele the statement of this cocoon being that of a Lepidopterous insect. The observation of Mr. MacLeay having applied to the supposed gall of Cecidoses figured by Mr. Curtis on the same plate, and which Mr. MacLeay informs me is the cocoon of a Lepidopterous insect, and not a gall.

221. The family Cetoniidæ has formed the subject of an Essay by Mr. MacLeay in the *Illustrations of the Zoology of Southern Africa.*

231. line 34. This passage was written (but not published) previous to the publication of the second edition of Stephens's *Nomenclature*, in which the genera of Buprestidæ were introduced.

281. line 23. for "palpi to appear to belong, this" read "palpi, appear to belong to this."

304. *Fig.* 35. 1. The antennæ ought to have been inserted at the base of the rostrum.

365. line 21. for "naturally" read "materially."

EXPLANATION OF PLATE.

Order COLEOPTERA.

Fig. 1. Cicindela hybrida *Linn.* (Linn. Cab.)
Fig. 2. Anomala Donovani *Steph.* (Brit. Mus.)

Order NEUROPTERA.

Fig. 3. Boreus hyemalis *Latr.*

Order HYMENOPTERA.

Fig. 4. Dicladocerus (*W.*) Westwoodii *Steph.*
Fig. 5. Platymischus (*W.*) dilatatus *Steph.*

Order STREPSIPTERA.

Fig. 6. Stylops Spencii *Pck.*

Order HEMIPTERA.

Fig. 7. Aphelocheirus æstivalis *Westw.*

Order HOMOPTERA.

Fig. 8. Dorthesia characias, ♂, *Latr.*

Order DIPTERA.

Fig. 9. Phthiria fulva, ♀, *Latr.*

MODERN CLASSIFICATION

OF

INSECTS.

I. Observations upon Insects in general.

Insects, as proposed to be treated of in the following pages, may be defined to be, Annulose Animals breathing by tracheæ, having the head distinct, and provided in the adult state with six articulated legs and antennæ, subject also to a series of moultings previously to attaining perfection, whereby wings are ordinarily developed.

This definition, which comprises the characters of the Ptilota or winged insects, of Aristotle, does not, indeed, accord with that required by the group of insects as extended by many recent authors; but the group thus defined is regarded Mr. MacLeay (*Linn. Trans.* vol. xiv. p. 67.) as pre-eminently natural, and as constituting the typical division of Annulose Animals; and, indeed, when we call to mind the general characters of the classes of the Annulosa and other invertebrated animals, it will appear evident, that the extraordinary metamorphoses to which the Ptilota are subject, attended as they are by the ulterior development of organs of flight, which exist in no other group of invertebrates, ought to be regarded as especially entitling these insects to be treated not only as a distinct, but as a most natural, group*, and consequently as giving a superior degree

* It will, perhaps, be objected by some persons, that the existence of metamorphoses, as an exclusive character, is denied by the researches of Mr. Thompson, who has asserted that the Crustacea undergo equally striking transformations. I have, however, and I trust satisfactorily, disproved the statements of this author, in a Memoir published in the *Philosophical Transactions* for 1835. It may also be said, that the character employed by Mr. Newman to isolate the winged insects (that of their incapability to reproduce their limbs) ought to have been employed. But this character has also been long since refuted by Dr. Heineken in the *Zoological Journal*, and by Dr. Burmeister in his *Handbuch der Entomologie*

of weight to that system in which they are regarded as distinct, over the numerous other methods which have hitherto been proposed from time to time, of some of the more celebrated of which it will be convenient to give a very short notice.

Linnæus and his disciple Fabricius introduced into the great division of Insects, not only those subject to metamorphoses and the acquisition of organs of flight, but also all other articulated animals possessing articulated legs, which formed in the Linnæan system the order *Aptera*, but which Fabricius separated into several other classes. In the former of these systems we perceive the great disadvantages attendant upon the employment of a single character in our attempts to arrange zoological objects, since the order Aptera regarded as equivalent in rank with the orders Coleoptera, Lepidoptera, &c., comprised not only apterous hexapod, and polypod insects, but also Crabs and Spiders, which more recent anatomical investigations have proved to be respectively groups of equal rank with all the winged orders united together. The elaborate researches of Cuvier in comparative anatomy fully proved, that the Crabs and other allied animals (genera — Cancer, Oniscus, and Monoculus, *Linn.*) could not be retained amongst insects, inasmuch as they possessed a totally distinct system of respiration, breathing by means of bronchiæ or gills, as well as a complete system of circulation: of these, therefore, he formed the class Crustacea, which has been regarded as distinct by all subsequent entomologists. Lamarck on similar grounds removed the spiders, and some other species of Apterous insects (genera — Aranea, Scorpio, and Phalangium *Linn.*), constituting them into the class Arachnida, including therein, however, the Mites (G. Acarus, *Linn.*), which breathe by means of tracheæ; the Centipedes (G. Scolopendra and Iulus *Linn.*), the spring-tailed insects (G. Lepisma, and Podura *Linn.*); and the Lice (G. Pediculus *Linn.**) These four last-mentioned groups have much perplexed systematists, none of whom are agreed as to their location, and by several of whom their situations have been frequently altered. By Dr. Leach† the Mites were raised to the rank of a distinct class, under the name of Acari; the Centipedes were also elevated to the rank of a class under the name of Myriapoda *Latreille;* whilst the spring-

* The two remaining Linnæan genera are, Pulex (the flea), subject to metamorphosis; and Termes, which belongs to the order Neuroptera.

† In Samouelle's Comp. p. 75.

tailed insects (as an order named Thysanura from Latreille), and the lice (as an order named Anoplura or the Parasita *Latr.*) were united with insects as a subclass under the name of Ametabolia.* Mr. Curtis has adopted the group of insects as thus extended by Dr. Leach. By Latreille the spring-tailed insects and mites have been constantly regarded as belonging to the class of insects, from their possessing six legs, in common with the metamorphotic insects; and the mites have been constantly regarded as portion of the class Arachnida, from possessing in common with the spiders eight legs. The Centipedes, however, have been variously regarded by Latreille, either as forming a distinct order of insects, under the name of Myriapoda (as in the 2d edition of the *Regne Animal*), or as constituting of themselves a distinct fourth Annulose class (as in his last work, *Cours d'Entomologie*, 1831.)

Messrs. Kirby and Spence have adopted a classification totally different from that of all preceding or subsequent systematists, in which three Annulose classes are formed, namely, Crustacea, Arachnida, and Insecta; but the latter is augmented by the hexapod spring-tailed insects and lice, the octopod mites, and the polypod centipedes, all of which are regarded as forming a single order, Aptera, characterised by respiring by tracheæ, and having no system of circulation. (*Introd.* iii. p. 22.) The incongruous character of the groups thus associated together; the possession of pulmonary sacs by Thelyphonus, which is thus placed amongst the mites; the recent researches of M. Dugés on the respiratory organs of Dysdera and Segestria, read before the Academie des Sciences on the 9th February, 1835, (clearly demonstrating that the respiratory system in the Arachnida is not entitled to pre-eminence as a character of the class); and, lastly, the admission of Messrs. Kirby and Spence themselves (*Introd.* iv. 383.), that their order Aptera is not a natural, but merely a provisional one, and that the hexapod insects are to be regarded as more peculiarly entitled to the denomination of Insects (*Introd.* iii. 22.), will, I trust, be considered as sufficient to authorise me in not adopting their views.

Mr. Stephens, in addition to the ordinary metamorphotic groups, has added the lice (Anoplura) to the class of insects, without, however, offering an argument for this deviation from all previous systems. The general construction of the hexapod antenniferous body of the

* Edinb. Encycl. vol. ix.

lice approaches very closely to that of such of the very few true insects, which undergo an imperfect metamorphosis, without their wings being developed; as the bed bug, certain apterous Orthoptera, &c.

Dr. Hermann Burmeister has, however, introduced both the spring-tailed insects and the lice amongst insects; placing the suctorial lice (Pediculidæ) in the order Hemiptera, and the mandibulated lice (Nirmidæ) and the spring-tailed insects in an order with Libellula, Ephemera, Termes, and Psocus. (Comp. his *Handb. der Ent.* vol. i. § 352., and vol. ii. p. 39., and *De Insect. Syst. Nat.* 1829.) He appears to have been led to adopt this arrangement by giving too slight a weight to the developement of organs of flight; citing, in support of his views, the occasional apterous conditions of certain true insects, and even the occasional absence of wings in one of the sexes, as in the glow-worm. In these instances, however, I can see but exceptions to a general rule, for which allowances ought to be made, and, consequently, as not warranting the introduction of entire groups of Apterous animals into the class.

It only remains for me to mention the system of Mr. MacLeay; which, from the philosophical manner in which the subject has been treated, merits particular notice. In this system, the metamorphotic Annulosa are regarded as the true insects; the classes Crustacea and Arachnida are introduced, with the limits given to them by Latreille; but the four other groups, which have already occupied so much of our attention, are, together with another group of Annulose animals, formed into a separate class, under the name of Ametabola, "having no metamorphosis in the usual sense of the word, or only that kind of it, the tendency of which is confined to an increase in the number of feet." (*Linn. Tr.* xiv. p. 66.) All these Ametabola are destitute of wings, but their respiratory system is similar to that of the true insects. It would occupy too much space were I to recapitulate the arguments adduced by Mr. MacLeay, as to the propriety of the establishment of this class; I must, therefore, refer the student to the fifth and sixth chapters of the second volume of the *Horæ Entomologicæ*, premising only that I have adopted this classification, because it leaves the true winged metamorphotic insects as distinct from the other groups, and without expressing any opinion upon the Quinarian views of Mr. MacLeay, or upon the introduction of the Vermes amongst the Ametabola.

Having thus determined the limits of the class of Insects, a slight sketch of their structural characters, and their distribution into orders, will next occupy our attention.

II. General Structure of Insects.

The word *Insect*, derived from the Latin (*in* and *seco*, *sectum*), indicates one of the chief characters of this group of animals; the body in which is not only composed of a continuous series of segments, articulating with each other, but is also often divided or cut into three very marked portions, to which the names, head (*caput*), thorax, and abdomen have been applied. Unlike the higher animals, insects are not internally furnished with a bony skeleton; but, to supply its want, the external envelope is ordinarily of a corneous-like texture, to which, on its inner surface, the muscles are attached, and which encases the viscera and other internal organs.

This *external Envelope* is, therefore, the analogue of the skeleton of the mammalia, the external organs of locomotion being attached to it. In its chemical composition, this envelope is peculiar, consisting of a substance which has been named Chitine, which is found only in the teguments of articulated animals. To this is added a certain quantity of albumen, an animal matter, certain salts, and an oil of variable colour, which last is generally disposed near the external surface, and supplies the varying colours so much admired in this tribe of animals.

The *Number of Segments*, whereof the body of insects is composed, appears, at first sight, to be very variable, but this is more apparent than real; being caused either by the soldering together of certain of these segments, or the rudimental state of others, in consequence of the superior developement of the adjacent segments. It is, however, to be observed that, owing to the non-developement of wings and generative organs in the larva, the body, in this state, is more regularly segmented, and the segments more equally sized, than in the imago state. It has been supposed that the *typical number of segments* is thirteen; but some late observations upon the larvæ of Hymenopterous insects, and upon the common earwig (*Trans. Ent. Soc.* vol. i. p. 157.), have led me to consider that the number is greater. From the elaborate researches of Audouin and MacLeay into the structure of the thorax of hexapod insects, it has been considered that each of

the primary segments is typically composed of four other segments; but as it is only in the thorax that this complex structure is to be traced, I shall notice it in describing that part of the body.

The *Distribution of the Segments* of the body of insects into three distinct regions (head, thorax, and abdomen), although not observable in the early states of existence of many species (*ex. gr.* larvæ of Lepidoptera), wherein the body is composed of a series of nearly equal-sized continuous rings, is so essentially indicated in the last and highest state of perfection of the animal, that we may, with propriety, adopt the Linnæan division of the body, into head, thorax (*truncus* L.), and abdomen; but the limbs (*artus*), being attached to the segments forming the thorax, are to be regarded as appendages thereto, and not as distinct primary parts of the body, in the same manner as the antennæ and trophi are appendages of the head; and the ovipositor, sting, caudal forceps, &c., appendages of the abdomen. These three primary divisions of the body appear to be adapted for distinct objects of equally great importance in the physiological relations of the animal. The head comprises the organs of sense, and consists of a single segment. The thorax comprises the organs of locomotion, and is composed of the three following segments; and the abdomen, which contains the generative organs, comprises the remaining segments.

The *Head* is a generally corneous, and often somewhat globose, skull; having an opening in its anterior part for the reception of the organs of the mouth (*trophi*), and a similar opening at its posterior part, where it is attached to the following segment, and through which the œsophagus or other anterior part of the digestive canal passes. On each side of the head is fixed an immoveable eye, of large size and complex structure, between which are occasionally two, or oftener three, minute simple lenses (*ocelli*). Towards the front of the head, but behind the mouth, are also attached two moveable organs, of endless variety of form, size, and structure, which are termed antennæ, and of which the precise uses have not been determined. The front margin of the head is often separated by a suture from the remainder of the skull, and is then termed the Clypeus. The under surface of the head is the Jugulum K. (Gula, Strauss, and Burm.), the swollen anterior margin of which is the "piece prébasilaire" of Strauss and Burmeister (*Manual*, pl. iii. f. 12. *d*, *d*), being the stipes of MacLeay, and the mentum and insertion of Newman. It is to the front margin of this swollen part that the true mentum is attached.

The form of the head and of its various organs is exceedingly varied; the variations of the mouth are of the highest importance, serving for the primary divisions into orders.

The *Antennæ* are generally elongated, and consist of a number of rings attached together, but varying in structure, not only in almost every species, but also in the sexes of the same species; those of the males being often much more complex than those of the females. These organs, from their existence only in insects and other articulated animals, as well as from their diversity of structure, have attracted much attention, and have been employed as excellent distinctive characters of genera, &c. They have received the names of filiform (thread-like), setaceous (bristle-like), moniliform (necklace-shaped), cylindrical, prismatic, ensiform (sword-like), fusiform (spindle-shaped), aristate (terminated by a hair), dentate (toothed), serrated (saw-like), pectinated (comb-shaped), flabellated (fan-like), ramose (branched), furcate (fork-like), geniculated (elbowed), perfoliated (with a knob, composed of loosely attached joints), lamellate (with a plate-like knob), plumose (feathered), verticillate (with whorls of hair), &c., according to their various form and clothing.

The *Composite Eyes* are exceedingly varied in their size; sometimes, as in the male hive bee, nearly occupying the whole surface of the head: they are composed of a number of minute transparent corneous hexagonal facets, representing the cornea, and being more or less gibbous, according to the carnivorous habits of the species. The number of these facets is equally varied; thus in the ant there are but fifty, whereas in the eyes of the butterfly, according to Geoffroy, there are not fewer than 34,650. From the elaborate anatomical researches of Muller and others, it is evident that each of these facets operates as a distinct organ of vision; and from an interesting memoir lately presented by Mr. Ashton to the Entomological Society, it appears, that in some species (Libellula) the upper facets are of a larger size than the inferior; whence a distinct kind of vision may be supposed to be possessed by these different sized facets, according with the habits of the insect. A similar observation was made by Hooke in Tabanus.

The *Simple Eyes* (ocelli) are generally three in number, and arranged in a triangle on the crown of the head; they are of a simple and semiglobular form. The eyes of larvæ, spiders, and some other Annulosa are simple ocelli, arranged in groups.

The *Organs of the Mouth* (upon the variations in which Fabricius constructed his system) are, notwithstanding all their variety of form, reducible to one type of structure. They consist of six principal organs, of which four are lateral and disposed in pairs: the two others are opposed in the opposite direction: thus, ⁘, filling up the space left by the two other pairs above and beneath. The upper single piece is the upper lip (labrum): the upper lateral pair of organs are the mandibles or upper jaws; the lower lateral pieces are the maxillæ, or lower jaws, and the under single piece is the under lip. The three lower organs are furnished with articulated appendages (*palpi*). The first principal variation in the structure of the mouth originates in the mode of action of the various organs. Thus, when the lateral pieces are short, inserted at a distance apart, and have a horizontal motion, the action is that of biting; when, on the other hand, the lateral pieces are elongated, originating near together, and having a longitudinal motion (by means of strong and elongated muscles at their base), the action is that of sucking; the ascension of fluids in the latter case being produced by the gradual approximation of the pieces of the mouth (*Latr. Cours. d'Entomol.* p. 206.), which thus form a siphon or haustellum. The insects having the former action are termed Broyeurs by the French, and Mandibulata by the English, and the latter Suçeurs, or Haustellata; but as these terms are liable to objection (the insects composing the latter group possessing mandibles, although in an altered form), it would be convenient to employ some other names. The terms Dacnostomata and Antliostomata express the properties of the two groups, without involving the contradiction suggested by the terms ordinarily in use.

In the *Biting Insects*, the upper lip is generally a simple and flattened plate closing the mouth above; the mandibles are generally horny, and more or less toothed (the teeth being, however, portions of the jaw itself), serving for gnawing in pieces the particles of food; the maxillæ are more complicated, being furnished at the side with an articulated appendage like a short antenna, but of which the number of joints is never more than six. The maxilla itself is terminated by two lobes, the exterior of which is sometimes articulated, representing an internal palpus as in Carabus, sometimes formed into a helmet-like appendage (*Galea*), protecting the inner lobe as in Locusta, and sometimes soldered to the inner lobe. The lower lip is still more complicated: its base is a horny plate (*mentum*, or the labium of

Fabricius): this is followed by a generally membranous organ (*labium* or the ligula of Fabricius), near to the external base of which is attached a pair of short articulated palpi; within this terminal labium is to be seen a fleshy organ, often forming its internal coating, but which in the dragon-fly and the grasshopper is a separate piece (*lingua*), and of which the lateral anterior angles (*paraglossæ*) are occasionally prominent. Such is the general character of the mouth of the Coleoptera, Orthoptera, Neuroptera, and Hymenoptera. In the bees, however, the three inferior organs of the mouth are elongated, so as when in action conjointly to form a sucking apparatus; the mandibles, however, retain their ordinary form. Latreille, notwithstanding, terms this form of mouth Promuscis, a term long previously given by Kirby and Spence to the mouth of the Hemiptera.

Amongst the *Suctorial Insects*, there is a much greater diversity of structure in the mouth. In the Hemiptera and Homoptera, the upper organ is very short and pointed; the four lateral pieces are elongated and transformed into slender lancet-like organs (the maxillary palpi being obsolete), enclosed within the equally elongated fleshy and articulated lower lip, which is turned upwards at the sides, forming a canal, up which the fluid food of the insect ascends; the labial palpi are also here obsolete. This variation of the mouth is termed by Kirby and Spence, promuscis; but by Fabricius, Olivier, and Latreille, rostrum. In the Diptera, the five upper organs, together also with the internal tongue, are elongated into lancet-like organs, the maxillary palpi being attached at the base of the maxillæ. These six organs are inclosed in a fleshy thickened piece (which is the lower lip), terminated by two large fleshy lobes which act as suckers. In many species, however, some of these lancet-like organs are obsolete. This kind of mouth is termed by Kirby and Spence, Linnæus and Fabricius, a proboscis. In the Lepidoptera, the three upper organs are almost obsolete, but the maxillæ are greatly elongated into a delicate instrument, which when at rest is spirally folded up and hidden from sight, but when in action, is extended and thrust to the bottoms of flowers. At the base of these maxillæ, a pair of minute palpi is often to be found. The lower lip is soldered to the head, but it is furnished with a pair of large palpi clothed with scales, which serves for the defence of the spiral maxillæ. By Kirby and Spence, this kind of mouth is termed antlia; by Fabricius, lingua; and by Latreille, spirignatha (or more properly speirignatha). In the Apha-

niptera, the organs are all exposed, the upper lip, mandibles, and tongue elongated, the maxillæ and labium short and furnished with articulated palpi. It is called rostrulum by Kirby and Spence, and rostellum by Latreille, which latter name had been previously employed by Kirby and Spence for the mouth of the Pediculus, but which Latreille has termed Siphunculus.

The *Thorax*, on account of its being the chief seat of the various organs of motion, is extremely complicated and variable in its structure; and it is only within a few years that its investigation has been philosophically entered upon, or a concise nomenclature of its parts, founded upon such investigations, proposed. It is the truncus of Linnæus, and comprises the three segments following the head, which have been respectively termed prothorax, mesothorax, and metathorax, which were originally proposed by Nitzsch. The first of these segments bears the anterior pair of legs, the second supports the middle pair of legs and the anterior pair of the organs of flight, and to the third are attached the posterior pair of legs and the posterior pair of wings. A binary division of the thoracic segments has been proposed, founded upon the nature of the organs of motion; thus the anterior of the three segments is the manitrunk of Kirby, the collum of Knoch, and the corselet of Strauss; whilst the two posterior wing-bearing segments are united into the "segment alifère" of Chabrier, the alitrunk of Kirby, the pectus of Knoch, and the thorax of Strauss. The composition of each of the thoracic segments (and indeed of every segment according to the views of Audouin) is essentially similar, consisting of four dorsal subsegments, namely, the Præscutum, Scutum, Scutellum, and Postscutellum; and the Paraptera, Sternum, Episterna, and Epimera, which are lateral or ventral pieces. In the Hymenoptera, Diptera, and Lepidoptera, the prothorax is almost evanescent or reduced to a simple collar; but in the Coleoptera, the pronotum (its upper surface) is the very large piece succeeding the head, and which has from the days of Linnæus been ordinarily but incorrectly termed the thorax, and its subsegments are entirely confluent, this segment being destitute of wings; indeed, it is only in the prothorax of some Locusts that the dorsal subsegments of the prothorax can be traced. But in the Mesonotum and Metanotum (or dorsal parts of the meso- and metathorax) the subsegments are much more conspicuous, indeed the scutellum of the mesothorax was noticed by Linnæus as one of the chief component

parts of the trunk or thorax, being the small triangular piece which is seen at the base of the suture of the elytra of beetles. The chief ventral or pectoral piece in each of the three thoracic segments is the Sternum, which varies considerably in its size and form: thus in the Elateridæ the *pro*sternum is elongated into a point extending between the middle legs, whilst in the large Hydrous piceus the Mesosternum and Metasternum are soldered together between the middle legs, the former projecting in a point between the anterior legs, and the latter extending far beyond the base of the hind legs. The modifications of form in the various thoracic segments result from the complicated machinery requisite for the due performance of the two chief kinds of insect locomotion, namely, leg-movements of various kinds, and wing-movements; but more especially from the great diversity of the wings and the occasional transfer of wing-motion to a single pair of wings, this pair being either the anterior, as in Diptera, or the posterior, as in Coleoptera: thus, whilst in insects which have the four wings of nearly equal size, the two aliferous segments of the thorax being also of nearly equal size, and their subsegments similarly developed (*ex. gr.* Hemerobius); those tribes of insects which have one or the other pair of wings more especially developed; have the segment to which such pair of wings is attached consequently increased in size: thus in Diptera the mesothorax nearly occupies the entire thorax, there being only mesothoracic organs of flight. In the Hymenoptera, the posterior wings exist, but of a small size; the metathorax is therefore much larger than in the Diptera, but much smaller than the mesothorax. In like manner, in those orders which have the posterior pair of wings enlarged, the mesothorax is diminished, and the metathorax equally enlarged: this is especially the case in the Beetles, but still more strikingly so in the Strepsiptera, are as destitute of fore wings as the Diptera are of hind ones.

The *Wings*, or organs of aerial progression, (upon which the Linnæan arrangement is principally founded,) bear no resemblance to those of birds, being, on the contrary, more analogous to the wings of bats, consisting ordinarily of a delicate double membranous plate, traversed by more or less numerous tubes, which Dr. Leach regarded as representing a system of bony air vessels (Pterygostea), but which the recent microscopical observations of Mr. Bowerbank and others have proved to be veins. These organs of flight, with respect to their consistence, are termed elytra, hemelytra, tegmina, membra-

naceous wings, halteres or pseudo-halteres. In the Coleoptera the upper pair of wings is transformed into a pair of corneous cases (*elytra*), generally extending to the extremity of the body, and, when unemployed, shutting closely together by a straight suture down the back. Thus united, they become a shield of great strength, defending the posterior pair of wings, which, when at rest, are transversely folded up beneath them, and which, when the insect is on the wing, are its only effective organs of flight. This lower pair of wings is membranous, and traversed by various corneous veins. In the orders Orthoptera and Homoptera the anterior wings (tegmina), when at rest, form a roof-like shield to the posterior wings, although much less effective than that of the beetles, since they are of a much more coriaceous texture. The posterior wings themselves are membranous, of a large size, and, when at rest, they are longitudinally folded. During flight, both pairs assist in locomotion. In the Heteroptera, the anterior wings (*hemelytra*) are coriaceous throughout their basal half, and membranous throughout their apical portion; the posterior wings are of moderate size, membranous, folded longitudinally at rest, and defended by the hemelytra, which shut horizontally, the membranous portion of the one folding upon the same part in the other. In the Neuroptera the wings are generally of equal size: they are of a membranous texture, and the posterior are seldom defended when at rest by the anterior, and they are consequently not folded up: whilst in the Hymenoptera and Lepidoptera the anterior wings are larger than the posterior, which are likewise never folded up. We thus see, that where the posterior wings take a large share in the act of flight, it is necessary that, being of a larger size, they should be folded up and defended by more or less powerful wing-cases while unemployed; when, on the other hand, the anterior wings take the largest share of action during flight, the posterior are so much reduced as to require no defence; in other words, where we find large and strong wing-cases or shields, the active organs of flight are membranous, large, and folded up. The veins, which I have already noticed, are extremely variable in their number: thus, whilst the wings of the Dragon-fly are covered with cells or meshes formed by the conjunction of these veins, the wings of some Hymenoptera are almost destitute of them. The numberand position of these veins and cells are of great use in determining the genera, especially of Hymenopterous and Dipterous insects. The wings of

the Lepidoptera are clothed with exceedingly minute feather-scales, which are rubbed off at the slightest touch, and which are somewhat analogous to the scales of fishes. In the Trichoptera and some Diptera the wings are more or less clothed with hairs. In the Diptera there is a pair of slender clubbed organs attached at the sides of the metathorax termed halteres, and which have been considered as representing the hind wings, whilst in the Strepsiptera a somewhat similar pair of twisted organs are placed at the side of the thorax, in front of the wings: these have been termed pseudo-halteres, and are the analogues of the fore-wings. In addition to the foregoing appendages, the prothorax is occasionally armed with a pair of moveable spines (*umbones* K. and S.), and in the Lepidoptera there is a pair of scales (*patagia* K. and S.) clothed with hair, distinct from the tegulæ, with which they are confounded by Burmeister (*Manual*, p. 77.). The latter organs acquire a large size in the Lepidoptera, and are the pieces clothed with hair, which repose upon the base of the wings. The Diptera are also furnished with a small membranous appendage (*alula*) attached to the posterior base of the wing, which Kirby and Spence regard as the true analogue of the posterior pair of wings: they are, however, decidedly portions of the fore wings; there exists a similar pair of winglets at the internal base of the elytra of the Dyticidæ, and which I have discovered equally developed in Hydrous piceus.

The *Legs*, or organs of terrestrial or aquatic progression, are six in number, attached in pairs to the three thoracic segments: they are articulated with the sternum of each segment, and are composed of a series of articulations, united together in such a manner as to permit the required movements; thus when the insect is pre-eminently cursorial, the basal articulations are freer than in those species which being natatorial, the movement is confined to a simple working forwards and backwards of the leg. In other species, which are saltatorial, the hind legs are elongated and thickened, for the purpose of giving support to the strong muscles by which leaping is performed; in other species, which are raptatorial, the forelegs are formed into a prehensile organ, whilst, in the fossorial species, the same legs are altered, so as to serve for burrowing or scratching in the sand. The chief divisions of the legs are the coxa, trochanter, femur, tibia, and tarsus: the coxa is the generally large and flattened piece which articulates with the sternum, of a variable form, and which assumes its maximum degree of development in Dyticus and Haliplus: the trochanter is a small piece connecting the

preceding with the femur, which, in general, is the thickest part of the legs, and generally extends beyond the sides of the body. In leaping insects it is especially incrassated and often toothed beneath. The next piece is the tibia, which is generally nearly equal in length, but more slender than the femur; it is an important piece of the leg, and is often armed with various appendages, especially at its tip, where they generally assume the appearance of spurs, or acute points (*calcaria*). The tarsus is a jointed piece, armed at its extremity with one or two slender curved hooks (*ungues*), and often accompanied by membranous or fleshy cushions (*pulvilli*). The number of joints in the tarsi varies from two to five. This part of the leg affords important characters for generical and family distinctions.

The *Abdomen* consists of a series of segments, for the most part destitute of any appendages, which last are to be found only in a few species, where they appear either as the external organs of generation, or as filaments, or other analogous pieces attached to the extremity of the body. These segments are attached together by membranes, and either meet at the edges or slide into each other like the tubes of a telescope; each of them is formed of two arcs, or semi-segments, one of which is dorsal, and the other ventral. The typical number of segments is rarely to be found in the perfect state, some of them being ordinarily employed in the construction of the organs of generation; in the male Earwig, however, nine distinct abdominal segments, exclusive of the anal forceps, are to be observed. The abdomen is attached to the posterior thoracic segment, either by its whole breadth, when it is said to be sessile, or by a slender portion of its base, which is called a peduncle: this latter mode of articulation is especially to be observed in the majority of the Hymenoptera, and some other orders. The chief appendages of the abdomen are the ovipositor, which is extremely varied in the different tribes, (being sometimes replaced by a powerful sting,) and the elongated setæ, forceps, or other analogous organs.

With respect to the *Internal Anatomy* of insects, a few brief notes must here suffice. They arrange themselves under the head of the sensitive, digestive, circulatory, respiratory, muscular, and generative systems.

The *Senses* of insects are dependent upon the action of the nerves, the system whereof in insects consists of a pair of medullary threads, exhibiting a series of knots or ganglia, whereby they are united

together at certain distances, but which ganglia are often confluent, especially in the imago state: from these knots or ganglia, an infinity of nerves ramify to the various organs, endowing them with the various senses of which insects are possessed. These are, vision, the external organs of which, the eyes, have been already shortly described; hearing, which insects clearly appear to possess, but upon the precise organ of which naturalists are not agreed; smell, of which the external organ is also unascertained; taste, the seat of which resides in the parts of the mouth; and feeling or touch, whereof it has been generally supposed that the antennæ were the chief organs, but of which the tarsi and the palpi have been respectively regarded as the instruments by various eminent physiologists.

The *Digestive Organs* consist of an elongated canal, composed of several distinct portions, which have been termed the pharynx, immediately connected with the mouth; the œsophagus, the craw, the gizzard, the stomach, and the intestines, terminating at the anal orifice: there are moreover a number of delicate elongated tubes, or biliary and salivary vessels opening into the digestive canal, the secretions whereof assist in the conversion of the food. The length of the canal varies greatly, being short in the carnivorous species, and often several times longer than the body in the herbivorous ones, whereof an excellent example will be found noticed in the family Coccinellidæ.

The *Circulatory System* has only recently been proved to exist. It had been long noticed that a series of large reservoirs, easily to be perceived beneath the transparent dorsal skin of many caterpillars, termed the dorsal vessel, and supposed to be analogous to the heart, underwent alternate contraction and dilatation, but it was supposed that no aperture existed from these reservoirs, and consequently that there was no circulation. This, however, at length appears to have been decidedly proved, by the researches of Carus, Strauss-Durkheim, Burmeister, and especially by the powerful microscope of Mr. Bowerbank, whose two papers in the Entomological Magazine sufficiently prove the existence of a circulation of a cold transparent and nearly colourless fluid, not only in the larvæ of ephemeræ, &c., but also in the veins of the wings of the perfect Hemerobius.

The *Respiration* of insects is effected by means of two great canals (tracheæ) running along the sides of the body, beneath the outer surface, and communicating with the atmosphere by means of numerous short tubes terminating at or near the sides of the body in breathing

pores (spiracles or stigmata), varying in their number; internally the tracheæ emit an infinite number of ramifications, extending to all parts of the body like the branches of a tree, and thus oxyginating the circulatory fluid which is diffused from the series of hearts throughout the various organs.

The *Muscles* of insects are not unlike those of the higher animals, being however attached to the inner surface of the external covering of the animal, but being far more numerous than in the human body, Lyonnet having discovered more than four thousand in the caterpillar of the goat moth, whereas there are in man only 529; they are attached to the various organs intended to be brought into motion by their assistance, being either flexors or extensors, levators or depressors.

Of the *System of Generation* it will be sufficient to observe, that in insects the sexes are constantly distinct, each sex being provided with its own peculiar generative organs; those of the female consisting of numerous ovaries and egg passages, and an ovipositor of varied construction, and frequently external; and that the impregnation of these eggs is produced by the union of the sexes. It is also to be observed, that amongst certain tribes of insects which are social in their habits, and where a certain number of individuals are required to perform the duties of the community distinct from those of reproduction, this effect is produced by the peculiar nature of the food given to these individuals whilst in the larva state, which has the extraordinary effect of retarding the development of their generative organs; moreover, there are other tribes (Aphides) in which a single impregnation suffices for several subsequent generations.

Shortly after impregnation, the female commences the laying of her eggs, an operation not performed without the utmost solicitude on the part of the parent for the welfare of her future offspring. The various means adopted for the purpose of placing the eggs in such situations as will ensure a due supply of food to the young when hatched, are amongst the most extraordinary instances of instinct with which we are acquainted.

When the young insect first makes its escape from the egg, it appears in a form generally totally unlike that of its parent, although in a few instances its form is that which it will retain through life. It is now termed a caterpillar, grub, or maggot (*larva*), and has a series of moultings to undergo, during the last two or three of which its form is more or less altered. In the earlier stages

of its growth it is termed a larva, but the state immediately preceding that in which it assumes its final or imago form is termed the pupa. The variations in the form of these several states in the different orders have been employed in the construction of the metamorphotic distribution of insects, to be subsequently noticed, which will render it unnecessary to enlarge upon them at any great length in this place. Insects, in respect to the relation of the larva with the imago, may be divided into two principal divisions which I have termed Heteromorpha, or those in which there is no resemblance between the parent and its offspring; and Homomorpha, or those in which the larva resembles the imago, except in the absence of wings. In the former the larva is generally worm-like and articulated in its form, of a soft and fleshy consistence, and furnished with a mouth, and often with six short legs attached in pairs to the three segments succeeding the head. In the latter, including the Orthoptera, Hemiptera, Homoptera, and certain Neuroptera, the body, legs, and antennæ are nearly similar in their form to those of the perfect insect, but the wings are wanting.

The Period of the Larvæ State is that in which the operations of feeding are especially carried on, and during which, owing to the rapid growth of the insect, whereby the outer envelope from time to time becomes too small for the creature, it is necessary that a succession of moultings should take place. When, however, the insect has attained its full size as a larva it ceases feeding, prepares for itself a retreat formed of various materials, but often composed of silk drawn from the spinnerets of the lower lip, and which is termed a cocoon. Within this retreat the insect again throws off its skin and appears as a pupa or chrysalis, in which the rudiments of the limbs of the imago are more or less distinctly seen. In the Homomorphous division, however, the pupa continues active, differing only from the larva in its increased size, and in having attained short rudimental wing-cases upon the back of the mesothoracic and metathoracic segments.

The *Pupa* is far more variable in its form in the different primary groups than the larvæ; and hence Fabricius* employed the characteristic name of the variation of the pupa to designate the general nature of the metamorphosis, whereby the metamorphosis of an insect is incorrectly said to be *incomplete* in Scarabæus and Apis, where the larva is quite unlike its parent, and the pupa pedate, but quiescent;

* Philosophia Entomologica, p. 56. § 6.

whereas this kind of metamorphosis is the most *complete* of any of the changes which insects undergo. This impropriety has resulted from the improper application of the Linnæan terms employed for the designation of the pupa: (Pupa completa, Spiders, &c.; semicompleta, Grasshoppers, &c.; incompleta, Bees, Ants, &c.; obtecta, Butterflies and Moths; and coarctata, two-winged Flies.)

When the insect has remained a certain period in the pupa state it again sheds its skin and appears in its perfect and final state; at first, indeed, its external envelope is humid and soft, but it soon dries and hardens by exposure to the air, acquiring at the same time its various colours. These modifications in the outer forms of insects are also accompanied by equally important changes in their internal structure as well as by the modifications in the economy of the insect consequent thereon.

III. Distribution of Insects into Orders.

This branch of Entomological Science has attracted much of the notice of naturalists in all ages; but it was not until the era of Swammerdam and of Ray, that philosophical principles were introduced and made the basis of the distribution of insects into primary groups. As, however, most of the systems of Entomology have been noticed at considerable length in the fourth volume of the *Introduction to Entomology*, I must refer the reader thereto, deeming it, however, essential to offer a few observations thereon.

Previous to the age of Swammerdam, the most vague ideas were entertained with respect to insects, of which the fanciful hypothesis of spontaneous generation was one of the most absurd. Hence, it is not to be wondered at, that Swammerdam (who together with Redi and Ray completely overthrew this system by establishing the theory of the universal developement of animals, ex ovo) was led to consider the principle of metamorphosis which he had so successfully employed against the spontaneous generationists, as of primary importance for the classification of insects. Indeed it is evident that the very nature of his studies, by which he had obtained so great a victory, could have had no other effect than to have produced the *Metamorphotic System of Insects*, detailed in his surprising and still invaluable *Biblia Naturæ*, and in which four primary divisions are established.

1. Insects subject to a change of skin, but undergoing no change of form. (Spiders, Lice, Woodlice, and Centipedes.)

2. Hexapod insects subject to metamorphosis, having an active pupa, in which the rudimental wings and wing-covers are exposed. (Bugs, Grasshoppers, Dragonflies, Mayflies.)

3. Hexapod insects undergoing metamorphosis, in which the pupa state is quiescent, either having the limbs enclosed in distinct cases (Beetles, Bees, Wasps, &c., and part of the orders Neuroptera and Diptera), or covered in an entire case (Butterflies, Moths).

4. Hexapod insects undergoing metamorphosis, the pupa state having neither motion nor wings, but enclosed in an ovate case (most two-winged flies and some other insects, whose transformations were not clearly understood by Swammerdam).

Various other classifications of insects, from the nature of their metamorphosis, have been from time to time proposed by different authors, amongst which it will be sufficient to notice the two following: first, that of Lamarck, in which insects are divided from the structure of the pupa as follows: —

1. Those having an inactive pupa (*Chrysalis*), enclosed and entirely concealed in an opake covering.
   - (1. a.) Chrysalis signata. Lepidoptera and some Diptera.
   - (1. b.) Chrysalis dolioloides. Diptera (coarctata.)
2. Those having an inactive pupa (*Mumia*), covered by a thin skin, through which the limbs of the insect are discernible.
   - (2. a.) Mumia coarctata - - { Coleoptera. / Hymenoptera.
   - (2. b.) Mumia pseudonympha - Neuroptera in part.
3. Those having an active pupa (Nympha) { Orthoptera. / Hemiptera. / Neuroptera in part.

The other proposed metamorphotic system is that given by Mr. Newman in an ingenious treatise published in the 9th Number of the *Entomological Magazine*, in which winged insects are divided as follows: —

Amorpha, in which the penultimate state is provided neither with mouth nor organs of locomotion; consequently it neither eats nor moves; neither does it bear any resemblance to the perfect state. Lepidoptera, Diptera.

Necromorpha, in which the penultimate state is provided with mouth and organs of locomotion detached from the body; but so

enveloped in a case that it can employ neither. The resemblance to the perfect state is very considerable, excepting in total want of motion. Hymenoptera, Coleoptera.

Isomorpha, in which all the stages are active and voracious, and of similar form. Orthoptera, Hemiptera.

Anisomorpha, in which appear the Amorphous, Necromorphous, and Isomorphous characters, together with a typical and distinct character. Neuroptera.*

It will be at once perceived, that these two systems are virtually almost identical. Mr. Newman's divisions of the Amorphous Adermata and Dermata are also identical with Lamarck's groups, Chrysalis signata and Chrysalis dolioloides, and the varied character of the Neuroptera is indicated by MacLeay. (*Horæ Ent.* and *Linn. Trans.* xiv. p. 68.)

Besides the five variations of metamorphosis constituting the diagnostics of Lamarck's five groups or sub-groups mentioned above, there are others of minor importance, which ought not to be omitted in a system established exclusively on Metamorphosis; thus some of the aquatic pupæ of the Adermatous Diptera are locomotive, whilst some of the Dermatous Diptera are nourished within the bodies of the parent, the Hippoboscidæ not being excluded from them until their arrival at the pupa state. Again, the Phryganeidæ, Libellulidæ, Ephemeridæ, Chalcididæ, Raphidiidæ, Coccidæ, and Aleyrodes, respectively offer various striking modifications in the nature of their metamorphoses; whilst in the pupa of Quedius tristis, *Waterhouse*, and some other Staphylinideous larvæ, the limbs are soldered as completely to the body as they are in the pupæ of the Lepidoptera. Hence I consider that the nature of the metamorphoses, if alone relied upon, will not afford a sufficient mode of classification.

We will, therefore, next proceed to notice the *Alary System*, or that

* In the Essay published by the same author, under the name of "Sphinx vespiformis," this order is formed into a central circle, around which are arranged the six preceding orders, forming as many circles. The distribution of the English groups have been arranged by the same author in his *Grammar of Entomology*, and in a memoir inserted in the second volume of the *Entomological Magazine*, upon the same system; of which Dr. Burmeister has remarked — "Die Eigenthumlichkeit dieses *neuen* Systemes is vollkommen bezeichnet, wenn wir ein allbekanntes Urtheil darauf anwenden, indem 'das Gute desselben nicht neu und das neue nicht gut' genannt werden kann." Weigm. Arch. V. 1. No. 4.

† Trans. Ent. Soc. No. 1. pl. iii. f. 2. *i*.

founded upon the structure of the organs of flight, of which Linnæus was the founder, and by whom insects were thus classed in accordance with the gradual diminution in the number and consistency of their wings.

Wings.
- 4
  - The anterior
    - horny, with a straight suture - - 1. Coleoptera.
    - semicrustaceous, incumbent - - 2. Hemiptera.
  - All
    - covered with scales - - - 3. Lepidoptera.
    - membranous, abdomen
      - unarmed - 4. Neuroptera.
      - with a sting - 5. Hymenoptera.
- 2 With a pair of halteres in the place of the posterior pair 6. Diptera.
- 0 *i. e.* Destitute of wings and elytra - - - 7. Aptera.

The celebrated Swedish naturalist, De Geer, proposed another distribution of insects in 1778, the primary and secondary divisions of which were formed for the most part upon the structure of the wings, which were also employed to characterise the orders. The structure of the mouth was, however, regarded as a secondary character of the latter; the consequence of which was the necessary and advantageous separation of the Caddice-flies and Ephemeræ from the other Neuroptera, under the name of Elinguia*; and the division of the Linnæan Hemiptera into three orders — Siphonata * (Cicada, &c.), and Dermaptera *, having a suctorial mouth (Cimex and Nepa), and Hemiptera * having a mandibulated mouth, (Mantis, Gryllus, Blatta, and Forficula.) The genera Coccus and Pulex were also respectively raised to the rank of distinct orders. The genera Termes and Psocus, together with the spring-tailed insects and lice, formed another order of the remainder of the Linnæan Aptera, which were divided into two others, thus forming fourteen distinct orders.

This was a great step made in the distribution of insects; and the partial success with which the employment of the variation of the mouth was attended, probably induced Fabricius to construct his *Cibarian system*, founded upon the characters of the Trophi alone. This was as follows: —

* *Mandibulated Insects.*

A. *Two pairs of jaws.*

a. *The lower pair Palpigerous.*

1. *Eleutherata* (Coleoptera *L.*, Beetles.) Maxillæ naked, free.

* These names were proposed by Retzius, the commentator of De Geer (*Gen. et Spec. Ins.* Lips. 1783.) That of Dermaptera has, by some accident, been misapplied by English entomologists for the Earwig, instead of the Cimicidæ, for which it was proposed.

2. *Ulonata* (Orthoptera *Ol.* &c. Grasshoppers, &c.). Maxillæ covered with a blade.
3. *Synistata* (Neuroptera partly *L.* and Thysanura *Latr.*). Maxillæ geniculated, and connected with the lower lip.
4. *Piezata* (Hymenoptera *L.*, Bees, &c.) Maxillæ corneous, compressed, and often elongated.
5. *Odontata* (Gen. Libellula *L.*, Dragon-flies). Maxillæ corneous, toothed.

b. *The lower pair of jaws, not palpigerous.*

6. *Mitosata* (Myriapoda, Centipedes).

B. *One pair of horny jaws, armed with a claw.*

7. *Unogata* (Arachnida, Spiders, Scorpions).

C. *More than two pairs of jaws.*

8. *Polygonata* (Isopod Crustacea, &c.). Jaws within the lower lip.
9. *Kleistognatha* (Brachyura, Crabs, &c.). Jaws outside of the lower lip.
10. *Exochnata* (Macrura, Lobsters, &c.). Jaws external, covered by palpi.

** *Suctorial Insects.*

11. *Glossata* (Lepidoptera, *L.*, Butterflies and Moths). A spiral tongue between palpi.
12. *Rhyngota* (Hemiptera *Latr.*, Bugs, &c.) A rostrum enclosed in a jointed sheath.
13. *Antliata* (Diptera *L.*, two-winged flies, &c.). Mouth with a soft exarticulate haustellum.

The harsh nomenclature of this system, joined with its many errors and the incongruous manner in which insects, the most widely apart, were brought into the same groups, producing altogether a most artificial and unnatural classification, gained for it but few followers.

The primary division, however, into mandibulated and suctorial insects, together with the adoption of some of De Geer's more natural groups, were further steps gained in the approach towards a natural distribution.

Entomologists had, however, by this time learned from the advantages and disadvantages connected with the Metamorphotic, Alary and Cibarian systems, but more especially from the more decisive

views opened to them by the researches of comparative anatomists, that it was necessary to have recourse to the entire characters afforded by the insect in all its stages, and with reference also to its internal as well as external organization. Here, however, we are met, as might indeed be naturally expected, by difficulties of a far greater weight than were caused by the employment of a single character in its various modifications; since a very slight acquaintance with any extensive group of insects will be sufficient to prove, that many characters which we find in one group, exhibiting a constancy of character, vary in the greatest degree in another, showing that although with the former they might, and indeed ought to be regarded of the highest importance, in the latter they acquire but a secondary consideration; thus, whilst some groups which agree in their wings, disagree in the structure of the mouth; others agreeing in metamorphosis, vary in their organs of flight.

The first attempts made towards the establishment of this, which has been called, the *Eclectic System*, were of course partial; thus Olivier, in 1789, proposed a system in which insects were divided into eight orders, distributed primarily from the wings, from which, as well as, secondly from the mouth, the characters of the orders were derived. Clairville on the contrary, in 1798, divided the winged insects into two groups, Mandibulata and Haustellata, from the structure of the mouth, whether furnished with jaws or a proboscis, characterising the orders from the wings. But it is to Latreille that we are indebted for the great advances made towards the perfection of this system. For nearly forty years was this author unceasingly occupied in improving the classification of insects; and it was by him that the introduction of family groups was effected, from which so great advantages were derived, by greatly limiting the number of the secondary groups; which from the cutting up of the more unwieldy Linnæan genera had become very numerous. It is true that his numerous successive publications exhibit variations in the classification of some of the orders; but this was the natural result of his labours, which were closed by the publication of his introductory work, the *Cours d'Entomologie*, in which the Hexapod Annulosa formed his fourth Class Insecta, distributed as follows: —

A. *Without wings, eyes generally simple.*

a. *Without metamorphoses.*

Ord. 1. THYSANOURA (Spring-tailed Insects). Mouth with jaws, tail forked.

Ord. 2. PARASITA (Lice). Mouth with a rostrum, tail simple.

b. *Metamorphoses.* (Pupa incomplete.)

Ord. 3. SIPHONAPTERA (Fleas).

B. *With wings, eyes facetted, and occasionally also with ocelli.*

a. (*Elytroptera.*) *Wings two, covered by two horny or coriaceous wing covers.*

* *Mouth with four jaws.*

Ord. 4. COLEOPTERA (Beetles). Wing-covers horny. (Pupa incomplete.)

Ord. 5. DERMAPTERA (Earwigs). Wing-covers horny. (Pupa semicomplete.)

Ord. 6. ORTHOPTERA (Locusts, &c.). Wing-covers horny. (Pupa semicomplete.)

** *Mouth, an articulated proboscis, enclosing setæ.*

Ord. 7. HEMIPTERA (Bugs and Cicadæ, &c.). (Pupa semicomplete.)

b. *Gymnoptera. Wings four, or two naked.*

* *Wings four.* † *With four jaws.*

Ord. 8. NEUROPTERA (Dragonflies, &c.). Wings reticulated. (Metamorphoses various.)

Ord. 9. HYMENOPTERA (Bees, &c.). Wings veined. (Pupa incomplete.)

†† *With a spiral tongue between two palpi.*

Ord. 10. LEPIDOPTERA (Butterflies). Wings powdery. (Pupa obtecta.)

** *Wings two.*

Ord. 11. RHIPIPTERA (Bee-parasites, &c.). Balancers, two in front of wings.

Ord. 12. DIPTERA (Flies). Balancers, two behind the wings.

There are, however, various objections to this system, which it will be seen has for its primary character the variation of the wings; thus, for instance, whilst the semicomplete-metamorphosed Orthoptera and Hemiptera were brought into contact, the mandibulated Neuroptera were separated from the Orthoptera, to which they are so

nearly allied. Mr. MacLeay has offered some other objections against Latreille's system, which he describes as one "expressing more importance to the aerial organs, and the texture of the body, than to the modifications of those organs upon which the very existence of the animal depends. 'Ainsi,' says Lamarck, 'les caractères si importans de la bouche ne furent nullement considérés, et cédèrent leur préeminence aux organes si variables de la locomotion dans l'air.'"—*Horæ Ent.* p. 360. I can, however, by no means agree with Mr. MacLeay, in the inferior rank given to those organs, which, as before said, are the very organs which, by their extraordinary developement, prove the winged insects to be the centre or types of the annulose animals. Moreover, the variableness attributed by Lamarck to the locomotive organs is not less striking in the oral organs of some groups, as in the Lepidoptera, Hymenoptera, and Neuroptera; thus evincing the correctness of the remark already made upon the insufficiency of a single character, when attempted to be relied upon as an infallible key to the classification of this class of animals. This is not denied even by those authors who are disposed to admit the organisation of the mouth, as of the highest importance in the classification of insects; thus Savigny approves of the Lamarckian divisions into "broyeurs" and "suçeurs;" but adds, "je ne pense pas qu'on puisse tirer le caractère de ces divisions de la présence ou de l'absence des mandibules," because he considers the mouths of all insects to be "essentiellement composée des mêmes élémens." (*Mémoires*, ch. 1.). Latreille also has suggested the division of insects into two other groups, Gymnostomes, or those which have the parts of the mouth naked, and Thecostomes, or those in which some of them are bristle-like, enclosed in a sheath. The Lepidoptera, as well as the Hymenoptera, enter into the first of these divisions. (*Fam. Nat.* 334. 417.) In like manner, Dumeril (*Cons. Gen.* p. 9.) has remarked, that the lower lip and jaws of some of the Hymenoptera form an apparatus, having "le double faculté de *broyer* les alimens, et de les *pomper* par une sorte du succion;" and Messrs. Kirby and Spence (*Intr.* 111, 417.) remark, that "If the mode in which insects take their food be strictly considered, it will be found that in this view they ought rather to be regarded as forming three tribes; for the great majority of the Hymenopterous order, and perhaps some others, though furnished with mandibles and maxillæ, never use them for mastication, but really lap their food with their tongue: these, therefore, might be denominated

'lappers.'" And at a subsequent page (vol. iv. p. 366.), they regard Clairville's Mandibulata and Haustellata as secondary groups*, "being convinced from the numerous characters they possess in common, notwithstanding the different mode in which they take their food, that they form one connected primary group; in which opinion they are further confirmed by the variations that take place in their mode of feeding in their different states; some from masticators becoming suctorious (Lepidoptera), and others from being suctorious becoming masticators, (Myrmeleon, Dytiscus); which shows that this character does not enter the essential idea of the animal."

Much of the difficulty which has arisen upon this branch of our subject has been produced by regarding the relations of insects as exhibiting themselves only in a linear series. It is not necessary for me here to advocate either the quinary or the circular disposition of groups; but when I perceive that, by quitting the linear series we gain a decidedly greater number of points of contact, whereby groups, which in such linear series must be kept widely apart, are brought into juxta-position, I cannot but think, that some other than an undeviating chain of linear affinity is the correct mode of viewing the productions of nature. Now, Mr. MacLeay, by his system (which may be termed the *Representative System*), has obviated more of the difficulties already pointed out, than could by possibility be effected by any of the previous systems. Here, indeed, as he observes, in the *Horæ Entomologicæ*, "a beautiful regularity is perceivable, comprising those distinctions of Trophi, insisted upon by Fabricius, Cuvier, and Lamarck; those relations of metamorphosis, constituting the leading principle of De Geer, Olivier, and Latreille; and, finally, those characters from the organs of locomotion, upon which orders were founded by Aristotle, Ray, and Linnæus."

By reminding the student, that in the following tables the first and fifth order in each series are supposed to be as nearly related to each other as any other two contiguous orders (each series returning into itself and forming a circle), an idea may be gained of Mr. MacLeay's mode of distribution. The names printed in italics are

* Mr. MacLeay, in order to establish a quinary distribution of the Annulosa, considered the Mandibulata and Haustellata as classes, each possessing an equal rank with the Crustacea, Arachnida, and Ametabola. I cannot adopt this view; which, indeed, Mr. MacLeay has himself partially modified in his Memoir in the 14th volume of the *Linnæan Transactions*.

either those of the osculant groups connecting the orders, or of those insects which point out the connection of the orders.

Distribution of metamorphotic winged Insects from the "Horæ Entomologicæ," ii. p. 367., and "Linnæan Transactions," xiv. p. 67.

MANDIBULATA.	*Relations of Analogy.*	HAUSTELLATA.
1. TRICHOPTERA ? *K.* (Phryganea, Perla, Tenthredo.)	Metamorphosis obtected. Larva with membranous legs.	1. LEPIDOPTERA *Linn.*
Ord. *Bomboptera* M. L. (G. *Sirex.*)		G. *Pterophorus.* G. *Psychoda.*
2. HYMENOPTERA *Linn.* G. *Myrmecodes. Ants.*	Metam. incomplete or coaretate. Larva apod, or vermiform.	2. DIPTERA *Arist.*
O. *Strepsiptera* K. G. *Atractocerus.*		Fam. *Hippoboscidæ.* G. *Nycteribia,* leading to Arachnidous class.
3. COLEOPTERA *Arist.* Larvæ various.	Metam. incomplete.	3. APTERA (the Flea). (Larva apod, but of Coleopterous structure).
O. *Dermaptera* Leach. (*Earwig.*)		
4. ORTHOPTERA *Oliv.*	Metam. semicomplete. Larva resembling Imago.	4. HEMIPTERA *Linn.* (G. *Cimex.*)
G. *Mantispa.* O. *Raphioptera* M. L. (G. *Boreus.*)		Fam. *Hydrocorisa.*
5. NEUROPTERA *Linn.*	Metam. various, including subsemicomplete. Larvæ hexapod.	5. HOMOPTERA. (G. *Cicada,* &c.)
O. *Megaloptera* (G. *Sialis*). *Perlides,* leading to Trichoptera.		*Flata limbata* Fab. & G. *Aleyrodes,* leading to Lepidoptera.

The point of connection of the two circles, formed by the returning of these two series into themselves, is supposed to exist between the Trichoptera, and Lepidoptera, being effected by such species of the latter as have very long antennæ, like the Adelæ, and such as have the trophi obsolete, as Aglossa.

That objections existed against this mode of classification on various points of view, Mr. MacLeay was well convinced, and of which indeed he has enumerated several in the sixth Chapter of the *Horæ Entomologicæ,* besides which it may be urged that the minor details, and especially the construction of the majority of the osculant groups and orders are quite untenable Still, however, as a whole, it must be admitted that the various Metamorphotic, Alary and Cibarian characters have never before been brought to bear together with such weight as in the system now before us; which, far from regarding as all-perfect, I would rather consider as the first stepping-stone towards a natural system not founded upon a linear series of affinities, but

which it will require far greater investigations and much more elaborate research to bring to perfection than it has hitherto received.

Modifications of the system of Mr. MacLeay have been published by Messrs. Kirby and Spence, and Mr. Stephens. The former authors (*Introd.* iv. p. 368.), distribute the Metamorphotic Insects in the following manner.

* *Orders in which the ordinary Trophi all occur, or the mouth is perfect.*

1. Coleoptera. 2. Strepsiptera. 3. Dermaptera. 4. Orthoptera. 5. Neuroptera. 6. Hymenoptera.

** *Orders in which all the ordinary Trophi do not occur, or the mouth is imperfect.*

7. Hemiptera (divided into Heteroptera and Homoptera as sub-orders). 8. Trichoptera. 9. Lepidoptera. 10. Diptera. 11. Aphaniptera (the Flea).

Here we find the Strepsiptera interfering to prevent the passage between the Coleoptera and Orthoptera effected by the earwigs, the Neuroptera and Trichoptera far asunder, and other equally great objections.

Mr. Stephens (*Illustrations Brit. Ent.* Mand. i. p. 2., Haust. i. p. 2.), adopts the divisions, Mandibulata and Haustellata, placing in the former the orders, 2. Strepsiptera, 3. Coleoptera, 4. Dermaptera, 5. Orthoptera, 6. Neuroptera, 7. Trichoptera, 1. Hymenoptera; and in the latter the orders, 13. Hemiptera, 14. Homoptera, 8. Lepidoptera, 9. Diptera, 10. Homaloptera, 11. Aphaniptera, and 12. Aptera (or the lice which I have excluded, as above mentioned). Like Mr. MacLeay, Mr. Stephens regards these two groups as forming circles, the extremities of each being allied together.

Against these and other classifications*, which it would be too tedious to detail, and in which the number of the Linnæan orders is much increased, objections exist on the part of some authors who consider it more natural to place the Strepsiptera, Earwigs, Forest-flies, Fleas, Thrips, &c., in some of the old orders. Such groups, it is true, are of far more limited extent, and also of less decisive characters than the great groups; but it appears to me to be as erroneous to force them

* Amongst these, that proposed by M. Laporte, in his *Etudes Entomologiques*, ought not to be omitted; in which Termes, Libellula (with Perla and Ephemera), Aphis, and Coccus, are raised to the rank of distinct orders.

into the larger groups as it is to regard them as orders equivalent with the great ones, such as Coleoptera, Lepidoptera, &c. It is indeed impossible not to be convinced that in many of these groups the structure of one order is partially lost, and that of the adjacent one assumed, whence it would be as correct to place the insects in the one as in the other order. Indeed, it appears to me to be the strongest evidence of the forcing of nature to a preconceived system, when we see introduced amongst a number of animals, characterised by a constant peculiarity of structure in some important organs, an animal, or group of animals, which does not possess such character, and find such a step attempted to be justified on the plea that this organ is variable in other groups.

With a view to avoid some of the inconveniences which still exist in the distribution of insects, I would propose the following classification in which the approach of the Hymenoptera to the Trichoptera, and of the Lepidoptera towards the Diptera, as pointed out by Mac Leay, together with the direct passage between the Trichoptera and Lepidoptera, and the descending series in the first, and the ascending series in the second columns must be borne in mind.

CLASS OF HEXAPOD METAMORPHOTIC INSECTS.

Subclass, *Mouth with jaws.* (Dacnostomata *W.*)	Subclass, *Mouth with a sucker.* (Antliostomata *W.*)
Ord. HYMENOPTERA.	Ord. DIPTERA.
? Osculant Ord. *Strepsiptera.*	? Osculant Ord. *Homaloptera.*
Ord. COLEOPTERA.	? Osculant Ord. *Aphaniptera.**
Osculant Ord. *Euplexoptera* (Earwig).	
Ord. ORTHOPTERA.	Ord. HETEROPTERA (including the Water Bugs).
? (Thrips?)†.	?
Ord. NEUROPTERA.	Ord. HOMOPTERA.
?	?
Ord. TRICHOPTERA (Phryganea alone).	Ord. LEPIDOPTERA.
?	?

Moreover, the relationships existing between the opposite orders must not be overlooked. Since, in some instances, as between the

* The relationship of the Flea with the Hymenoptera, insisted upon by Strauss, does not appear to me to be well founded.

† Order Thysanoptera *Haliday*, by whom an elaborate paper upon this tribe of remarkable insects has been published in the *Entomol. Mag.* No. 15. April, 1836.

Orthoptera and Heteroptera, they are so strong as to become direct affinities according to some authors. As, however, it has been the fashion to commence the series of orders with the Coleoptera (which it is true is the greatest in extent), I have followed the general plan, the effect of which will be the introduction of the Hymenoptera and Strepsiptera between the Trichoptera and Lepidoptera. With this explanation we take our leave of the modern distributions of the *orders* of insects, which from the nature of the present work it would have been inconsistent to have passed over in a more concise manner; the reader having been put into possession, not only of the modes of classification adopted by all the most recent authors of any eminence, but also of the principles upon which such distributions have been proposed.

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Order COLEOPTERA *Aristotle.*

Char. Anterior wings (elytra) horny or leathery, concealing the posterior wings when unemployed, horizontal, united down the back by a straight suture.

Posterior wings membranous, longitudinally and transversely folded when unemployed.

Mouth with transversely moveable jaws.

Pupa incomplete.*

This order comprises the extensive tribes of beetles, and, in respect to the size of some of these insects, or the number of individual species, must be regarded as occupying the foremost rank amongst insects. From our earliest childhood, when, at school, we learned the cruel trick of putting a pin through the tail of a Cockchafer to see it "spin;" or caught the pretty ladybirds, and watched them take their flight from our hand, exclaiming, in the words of the childish couplet—

> "Ladybird, ladybird, prythee begone;
> Thy house is on fire, and thy children at home,"

we have been familiarized with the leading character of this order of insects, derived from the structure of the wings and elytra, from whence, indeed, the name of the order, signifying "wings in a case," was given to them by Aristotle. In the earlier editions of the *Systema Naturæ* it was even employed as its sole characteristic; so that the Grasshoppers, Cockroaches, and Earwigs were included in it; and,

* It has been usual to apply the character of the pupa to designate the peculiar nature of the metamorphosis in general. This is, however, very incorrect; since the Coleoptera are thereby defined to have an incomplete metamorphosis, whereas their metamorphoses are complete, in the ordinary acceptation of the word, the pupa being on the contrary incomplete. Moreover, Linnæus applied this and other similar terms to the pupa, and not to the metamorphosis; the confusion originating in their misappropriation by Fabricius.

in the last edition of this work, the last-named insect was still retained, from the straight suture by which the upper wings are united when unemployed. These insects, however, although nearly agreeing with the beetles in the structure of the mouth, are widely separated by the nature of their metamorphoses, which consist in a simple casting of the skin from time to time, the larva nearly resembling the perfect insect, the pupa being also similar, but furnished with rudimental wings, and being active; whereas, in the beetles, the larva is quite unlike the beetle, and the pupa inactive. So that, on the whole, this may be considered as one of the most definitely marked groups of the animal kingdom. Mr. MacLeay has indeed (*Horæ Entomol.* p. 421.) considered its insulation as the result of accident, although it is a group of that precise kind which he has since proved (in his *Letter upon the Dichotomous System*) to be a perfectly natural one.

The number of species of this order with which entomologists are actually acquainted cannot be less than 35,000*; and it is more than probable that, when the number of species of foreign climes shall have been collected, the number will be doubled, if not trebled, as we may, indeed, conceive by noticing the great proportion of European species already in the lists. In this surprising number we find the most brilliant colours and most singular forms, with a variation of size from the most bulky to the most minute of the insect tribes. Hence, it is not surprising that these insects should have attracted the great, and even absolute, attention of so many authors and amateurs; and which has probably been increased by the comparative largeness of size and superior consistence of their external covering, whereby they are rendered so much easier in collection, preservation, and examination.

In addition to the characters given above the following may be mentioned:—The head is furnished with a pair of antennæ, of which the form varies very greatly, even in the sexes of the same species, but which, except in a few instances, consist of eleven joints. The eyes are large and lateral; and, in a few species, each is divided by a horny sinus (being part of the skull), so that in these four eyes appear to exist, an example of which occurs in Gyrinus. The simple ocelli are here wanting, except in Paussus bucephalus, and some of the small Staphylinidæ, in which Dalmann observed two tubercles on the crown of the head, which he considered to be ocelli, but Latreille

* The Berlin Museum alone contains 28,000 species.

considered them as mere tubercles. Curtis and Brullé have, however, recently discovered a small frontal tubercle in some of the Dermestidæ, which appears to be an ocellus, as it is indeed named by the former. The mouth consists of an upper lip, generally transverse; a pair of horny jaws; a pair of lower jaws of less firm consistence, furnished with an articulated palpus, and a lower lip, also furnished with a pair of similar but shorter palpi; the lip itself (labium) arises from a transverse horny plate (mentum), articulated at its base with the head. The second segment is by far the largest; it is generally termed the thorax, but, strictly, it is only the first thoracic segment (prothorax), having the fore-legs articulated to it on the under side. Latreille has claimed the discovery of a pair of spiracles on the inner membrane of this segment; Messrs. Kirby and Spence had, however, previously noticed it. (*Introd.* iii. p. 43.) The second thoracic segment (mesothorax) is very short, and is scarcely visible from above when the insect is at rest, the only exposed part consisting of a triangular plate (scutellum, or, more strictly, scutellum of the mesothorax), on each side of which the elytra are attached; this segment also bears on its under surface the middle legs. The third thoracic segment (mesothorax) is larger in size than the preceding, bearing on its upper surface, near the anterior angles, a pair of membranous wings, and on its under surface the posterior legs, of which the basal joint is large and transverse. The abdomen is intimately attached by its entire breadth to this last thoracic segment, and generally consists of six or seven segments (the typical number being nine), each having a pair of spiracles at the sides, or upper surface; the tarsi vary in the number of the joints, from two to five.

In an order of such extent as the present, it is not surprising that some few variations from these typical characters should exist; thus in some, as the females of the Glowworm and Drilus, the organs of flight are entirely wanting. Many genera of Carabidæ, Curculionidæ, &c. have elytra, but no wings: in some the elytra are soldered together; others again, as Molorchus, Buprestis, &c. have the wings only longitudinally folded; others, as Meloe, have the elytra lapping over each other; and in some the elytra are narrowed, and do not meet in a straight line down the back, — Sitaris, &c. The only character which prevails throughout the order is that derived from the *metamorphosis*, which is of that species which has been termed

(but erroneously), incomplete, the term being applicable only to the pupa state. The *larvæ* are active, and generally resemble short thick worms, with the head and back of the anterior segments of the body scaly, and generally with a pair of short jointed legs attached to each of the first three segments, representing the three thoracic segments and the six legs of the Imago. The head is furnished with the same organs as that of the perfect insect, except that they are more rudimental; thus the eyes are represented by several small ocelli-like tubercles observable at the side of the head, and the antennæ are very short; the parts of the mouth are, however, more developed, as might be expected from the circumstance of the larva state being that in which the chief amount of nourishment is taken. The more inactive and retired these larvæ are, the more they resemble worms or maggots: thus the Nut Weevil, which is borne in the midst of its food, is destitute of legs. The larvæ of the carnivorous species are the most active, being furnished with robust legs; whilst some of the larvæ of the herbivorous species have the legs replaced by fleshy tubercles, which are even occasionally wanting. The last segment of the body is often furnished with horns or other appendages, and its under side provided with a fleshy retractile tubercle, which is employed as an additional leg, and even, as is asserted respecting the larva of the Glowworm, as an instrument employed in cleansing the body when soiled. Until the publication of the *Horæ Entomologicæ*, entomologists had neglected the study of these larvæ since the time of De Geer. Within the last two or three years, however, the attention of several authors has been directed to this branch of the subject, including Messrs. Waterhouse, De Haan, and Hammerschmidt. I have also been long engaged in the like manner, having observed the transformations of many species, as more fully to be mentioned in the various families. The *pupa* is inactive, the insect taking no nourishment in this state, it is of a dirty white colour, and often enclosed in a case composed of bits of earth or chips of wood, united by silken threads or viscid matter formed by the larva previous to undergoing its change. In this state the parts of the future beetle are plainly perceivable, being incased in distinct sheaths; the head is applied against the breast; the antennæ lie along the sides of the thorax; the elytra and wings are short, and folded at the sides of the body, meeting on the under side of the abdomen; the two anterior pairs of legs are entirely exposed,

but the hind pair are covered by the wing-cases, the extremity of the thigh only appearing beyond the sides of the body. In some few species of Brachelytra, as already mentioned, the limbs are so firmly soldered to the body, and apparently under a single sheath, that the pupa might almost be termed an obtected one. Some pupæ are enclosed in the cases in which the larvæ resided; but the habitations, economy, habits, and period of duration in the various states of these insects vary exceedingly.

Naturalists are indebted to Aristotle for the establishment of this order of insects, which embraced, according to his definition, all insects with encased wings, "οσα το πτερον εχει εν κολεῳ," and which has been adopted by subsequent authors. Fabricius, however, changed its name to Eleutherata, and Clairville to Elytroptera.

Linnæus described 891 species of these insects, which he divided into 29 genera, distributed into the three following sections: — *Antennis clavatis extrorsum incrassatis, * * Antennis filiformibus, and * * * Antennis setaceis. Geoffroy proposed numerous additional generic groups, and adopted a different mode of classification, dividing the order into two primary sections, from the elytra entirely or partially covering the abdomen, and subdividing these sections according to the numerical variations in the joints of the tarsi. This latter character was subsequently adopted by Olivier to distinguish the primary sections of the order, which were thence named as follows: — 1. *Pentamera*, in which all the tarsi are 5-jointed; 2. *Heteromera*, in which the four anterior tarsi are 5-jointed and the two posterior 4-jointed; 3. *Tetramera*, which have four joints in all the tarsi; and 4. *Trimera*, having only three joints in all the tarsi. To the four above-mentioned groups Latreille added another, named Dimera, composed of the minute family Pselaphidæ, which were supposed to have only two joints in all their tarsi. He, also in the *Règne animal*, proposed a sixth section, Monomera, for the reception of the Clambus armadillo, supposed to possess but a single joint in the tarsi; but the real affinities of these insects (the former with the Staphylinidæ,[1] and the latter with the Agathidiidæ), as well as the real structure of the tarsi, do not warrant the establishment of these two sections, the Pselaphidæ having three joints, and the Clambus, as I have ascertained, having four joints at the least in the tarsi. Cuvier, in his *Tableau Elementaire*, divided the order into 13 principal divisions, characterised by the forms of the antennæ, tarsi, palpi, and elytra.

Fabricius added a great number of genera, and distributed the order into ten divisons according to the form of the antennæ. The *Tarsal System* of Olivier has, however, been almost universally adopted, chiefly in consequence of Latreille having employed it in his numerous works. It would appear, however, from the observations of the last-named author, that he has always doubted whether its rigid adoption might not be inconsistent with nature. Thus, in several of his most valuable works, and especially in the *Genera Crustaceorum*, &c., we find him questioning the series of Coleoptera founded thereon; adding, "Coleoptera palpis sex, robustiora, agiliora, *primates* ordinis*; rhyncophora e contra instrumentorum cibariorum exiguitate, ore rostrato, debiliores, *Mammalia edentata* hic quodam modo æmulantes. Articulorum tarsorum progressio numerica decrescens in methodo naturali non admittenda." (Vol. i. p. 172.). In his *Considérations Générales*, he has entered more fully into this subject, discussing the distributions resulting from the employment of the antennæ, tarsi, and trophi, as leading characters, again giving the preference to the latter, but admitting his inability to propose a natural system, and therefore adopting the tarsal system.

Against this system it may be advanced, that by rigidly employing the numerical gradations of the tarsal joints, the real affinities of certain insects (such as the Pselaphidæ and Clambus, above mentioned) are disturbed. It appears to me, however, that these ought rather to be regarded as exceptions, such as constantly oppose the adoption of every rule, especially when founded upon a single character. I do not, therefore, with Mr. MacLeay†, regard these instances as affording in themselves a sufficient ground for overthrowing the tarsal system. But another and more forcible objection has been raised by Mr. MacLeay, namely, that the Tetramerous Beetles are, in fact, Pentamerous, and that the Trimerous are Tetramerous; each of these groups possessing a minute joint, observable between the two lobes of the supposed penultimate joint. It appears to me, however, that this objection can only be maintained against the *names* of these groups, and not against the *groups* themselves, which, as it seems to me, are

* Mr. Kirby more recently, on account of their perfection and symmetry of general structure, the lightness and velocity of their motions, and brilliancy of colours, has regarded the Cicindelidæ as the analogues of the Lion amongst quadrupeds, and as the typical and most perfect group of Coleopterous insects.

† Linn. Trans. vol. 15.

characterised by a strongly marked peculiarity of structure which it is impossible to overlook. * Mr. MacLeay is, however, of a different opinion; and, rejecting the tarsal system entirely, has proposed a division of the Coleoptera, founded upon their larva state, of which he describes the five following types:—

1. A carnivorous Hexapod larva, with an elongated linear and flattened body, having a large head armed with two sharp falciform mandibles, and furnished with six granular eyes on each side. Examples, Carabus, Dyticus. [Analogy with Scolopendra.]

2. An herbivorous Hexapod larva, with a long and almost cylindrical body, so fashioned that the posterior extremity being curved under the breast, the animal, when at rest, necessarily lies like an Iulus on its side. Examples, Petalocerous Larvæ. [Analogy with Iulus.]

3. An Apod larva, having scarcely the rudiments of antennæ, but furnished, instead of feet, with flat fleshy tubercles, which, when continued along the back and belly, give the animal a facility of moving in whatever way it may be placed. Examples, Curculio or Cerambyx. [Analogy with Vermes.]

4. An Hexapod and distinctly antenniferous larva, with a subovate rather conical body, of which the second segment is longer and of a different form from the others, so as to give the appearance of a thorax. Examples, Coccinella or Chrysomela. [Analogy with Pediculus.]

5. An Hexapod antenniferous larva, of oblong form, having, like the former, vestiges of a thorax, besides two or more articulated or unarticulated appendages to the last segment of the abdomen. Example, Meloe. [Analogy with Podura.]

"Each Coleopterous larva, I have observed, may be assimilated to one or other of these types, which it is scarcely possible to look at without being reminded of the primary types of the Ametabola. Indeed, it occurred to me almost immediately, that I had Chilopodiform, Chilognathiform, Apod or Vermiform, and Anopluriform larvæ, with a fifth form (Thysanuriform), of which, even now, I know little,

* Several French entomologists (Solier, Chevrolat, Brullé) have very recently rediscovered this minute joint, to which they have attached as much importance as Mr. MacLeay. The advantages resulting from the discovery are not very apparent when the Longicorn Beetles are separated from the other Tetramera, and brought into the Pentamera, as proposed by Mr. Brullé. M. Solier also (*Ann. Soc. Ent. Fr.* 1834, pp. xlii.), considers that all the Coleoptera are in fact Pentamerous.

except from the examination of two or three collected by myself, together with the marvellous descriptions of Goedart and De Geer." (*Horæ Entomol.* vol. ii. p. 422.) Subsequently the same author states, that " the types of Chilopodiform larvæ are those carnivorous insects with four maxillary palpi, forming two groups, Carabus and Cicindela Linn., and Hydrocanthari Latr. To the same tribe, Hydrophilus Geoffr. ought to be ascribed, from which, by Sphæridium, we enter among the Chilognathiform larvæ, the type of which is apparently Scarabæus Linn. The tendency of Chilognathiform larvæ is herbivorous, having among them Lucanus, Byrrhus, Ptinus, Hister, Elater, Buprestis, and part of Tenebrio and Dermestes. By means of Bostrichus Geoffr. we probably quit the Chilognathiform for the Apod or Vermiform larvæ, including Bruchus, Curculio, Attelabus, Cerambyx, Leptura, Necydalis, and part of Tenebrio and Dermestes. With the help of Donacia (nearly allied to Leptura), we quit this tribe for the Anopluriform larvæ, including Chrysomela, Cryptocephalus, Coccinella, Cassida, and Hispa. These last lead to the Thysanuriform larvæ, including Meloe and Mordella, with many Heteromera Latr., and perhaps Clerus. I suspect that some of the Malacoderma Latr., find a place in this group, but certainly Staphylinus Linn., reconducts us from these insects to the Chilopodiform tribe of larvæ. Some groups I dare scarcely venture on, such as Melasomes, Taxicornes, and Stenelytres Latr." We are then informed of the important fact, that Pentamerous insects chiefly belong to Chilopodiform or Chilognathiform larvæ; that Apod larvæ become Tetramerous; Anopluriform larvæ either Tetramerous or Trimerous; and Thysanuriform larvæ either Heteromerous or Pentamerous. * In the *Annulosa Javanica*, Mr. MacLeay declared his views relative to the Chilopodiform type or tribe as follows: —

		Ex. Typic.	Families.
1. *Normal group*, consisting of insects having linear or setaceous antennæ, with the outer process of the maxillæ palpiform. (ADEPHAGA *Clairville.*)	1. GEODEPHAGA.	*Carabus.*	Cicindelidæ. Carabidæ. Harpalidæ. Scaritidæ. Brachinidæ.
	2. HYDRADEPHAGA.	*Dyticus.*	Gyrinidæ. Dyticidæ.

* Horæ Ent. p. 464, 465.

		Ex. Typic.	Families.
2. *Aberrant group,* consisting of insects having their antennæ clavate, or at least gradually thickened towards the apex, while the external lobe of the maxillæ is not palpiform. [RYPOPHAGA *Steph.*]	3. PHILHYDRIDA.	*Hydrophilus.*	Heteroceridæ? Parnidæ. Helophoridæ. Hydrophilidæ. Sphæridiidæ?
	4. NECROPHAGA.	*Silpha.*	Scaphidiidæ. Silphidæ. Nitidulidæ. Engidæ. Dermestidæ.
	5. BRACHELYTRA.	*Staphylinus.*	Staphylinidæ. Stenidæ. Omalidæ. Pselaphidæ. Tachyporidæ.

The circularity of this tribe is supposed to be effected by the approximation of Lesteva amongst the Brachelytra to the Carabidæ. It must be borne in mind that the analogies existing between these five types of Coleopterous larvæ and the five groups into which Mr. MacLeay divides his class Ametabola, constitute Mr. MacLeay's chief argument in support of their correctness.* The above is the substance of Mr. MacLeay's hitherto published views upon this subject, whence the impossibility will be seen of following them out through the entire order, and which is indeed the more increased from our great ignorance of the larvæ of many important groups. We have seen also that Mr. MacLeay himself admits the existence of a variation in the tarsal structure concurrent with the variation in the form of the larvæ, a circumstance dependent, as it seems to me, upon the principle that modifications of the preparatory states of an insect ought merely to be regarded as indications of corresponding peculiarities in the final state, the former modifications being subordinate to those observed in the imago, having in fact been undergone with a direct view to the perfection of the insect. We might indeed carry the subject still further. Thus, whilst the intimate connexion existing throughout the whole of the Tetramerous Beetles cannot be denied, yet Cerambyx has a subvermiform and Chrysomela an

* It is to be observed, that Mr. MacLeay's views respecting the Ametabola have been adopted by no subsequent author, and that Messrs. Kirby and Spence (who regard Mr. MacLeay's proposed distribution as requiring much more consideration and investigation than have hitherto been given to it — *Introd.* iii. 161.) have pointed out numerous other and equally striking analogies existing between the Coleopterous larvæ and the Crustaceous and Arachnidous classes (*Introd.* iii. 166.)

anopluriform larvæ; whilst the latter and Coccinella (Mr. MacLeay's two examples of the Anopluriform stirps), although agreeing in the larvæ, are totally different in the habits and in the structure of the tarsi of the imago.

For these and other reasons which want of space prevents me from here detailing, but which I have embodied in a paper read before the Entomological Society, I have not considered it advisable in this work to adopt Mr. MacLeay's views until they shall be more fully developed*, and shall therefore follow (with proper restrictions

* Mr. Stephens has endeavoured to adopt MacLeay's views in the distribution of the Coleoptera (*Catalogue of Brit. Ins.* p. viii.), and it cannot be denied that some of the relations thus elucidated are very strong affinities; others, however, appear equally slight, not being more than distant analogies. It is to be regretted, that want of space has prevented him in his Illustrations from developing his own views so fully as could have been wished. I need not do more than mention the classifications proposed by Mr. Newman (*Ent. Mag.* No. 9.), and by M. Laporte (*Etudes Ent.* No 1.), these authors not having thought fit to detail the principles upon which their classifications (which certainly do not appear to be very consistent with nature) are founded. Mr. Kirby, however, in his *Fauna Boreali-Americana* (published subsequently to the preparation of the following pages relative to the Coleoptera), has proposed various important modifications in the general classification of the order, founded upon and accompanied by observations of their affinities, and of which it will be useful in this place to give a slight review. Many of these are of too great value to be overlooked; but not a few appear to me to be unfounded in nature. Rejecting the Tarsal System of Latreille, by a too great reliance whereon "groups evidently nearly related are scattered far and wide through his various sections," and also that of Mr. MacLeay, which he considers impossible to adopt through the "*mazy labyrinth*" of nature, he regards it as impossible "either to conceive or delineate it so as to maintain all its connections undisturbed and unbroken. We must do it in a series, which can only be a series of mutilations and dislocations." (*Pref.* p. xxiii.—xxv.)

Commencing with Cicindela, and passing through the remainder of the Adephaga (Carabus, Dyticus, and Gyrinus *Linn.*), he next enters into various anatomical arguments relative to the respective relations of the Brachelytra with the Adephaga (Latreille's method, but rejecting Latreille's location of the Buprestidæ, &c.), and of the Philhydrida with the same group (MacLeay's method), from which he considers that the Brachelytra by means of Lesteva (analogous to Lebia), and Stenus (analogous to Cicindela), are intermediate between the terrestrial Adephaga and the Necrophaga, whence he passes to the Philyhdrida, which bear a stronger relation to the aquatic Adephaga, and thus a circular distribution of these groups is completed. In this distribution the groups Geodephaga and Hydradephaga are made subsections, whilst the genus Necrophorus is raised to the rank of a section, equivalent to the Adephaga, Brachelytra, &c., under the name of Entaphia, a step surely not adviseable. The Byrrhidæ are introduced amongst the Necrophaga, and it is from this group that we are instructed to approach the Lamellicorn beetles by means of the Histeridæ. The Sphæridiidæ are also regarded as another transition

and allowance for occasional exceptions), the Tarsal System, which, from being in general use and of easy application for every practical purpose, is superior to any of the other modes of classification yet proposed.

The Coleoptera are therefore divisible into the four following sections: —

1. *Pentamera*, in which all the tarsi are 5-jointed, the fourth being of ordinary size.
2. *Heteromera*, in which the four anterior tarsi are 5-jointed, and the two posterior 4-jointed.

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from the Philhydrida to the Histeridæ, and as consequently completing the circle of the Chilopodomorpha of MacLeay, Hister being an osculant group. Passing the Histeridæ, which he considers to be as much allied to the Copridæ as to the Lucanidæ, he proceeds through the Lamellicorns, and returns to the Histeridæ to take up the Lucanidæ, some of which (Passali, &c.) appear to diverge by Bostrichus to the Weevils. He then takes up, without indicating their affinities, the Sternoxi (Elater and Buprestis), which he regards as entitled to a station somewhere between the Lignivorous Lamellicorns and the Capricorns; and, after simply hinting at the relation of the Sternoxi with the Malacoderma by means of Cebrio, he considers that there are two routes,—one from Lucanus to the Capricorns (through Cucujus, Pytho, and Trogosita), and thence directly to the Eupoda and Chrysomela; the other from Passalus through the G. Phrenapates K. Sinodendron, F., and an osculant tribe of timber-borers (Xylotrypa *K.*), including Ptinus L. (out of the direct line), Scolytus, Hylesinus, Bostrichus, &c., directly to the Weevils. This arrangement "keeps together the great body of Lignivorous Coleoptera." By means, moreover, of Anthribus and Clythra a connection is regarded as established between the Weevils and the Cyclica *Latr.* The Coccinellidæ next follow, but their natural place is not yet satisfactorily ascertained. To these succeed the Heteromera in their ordinary course, merely "because one of that subdivision, Meloe, appears evidently to be one of the links that connect the Coleoptera with the Orthoptera," — "which is proved not only by its galeate maxillæ, but by its elytra lapping over each other, and its vertical and often inflexed head, in this respect resembling the Blattina." We are lastly to retrace our steps to take a fresh route from the Sternoxi by Cebrio to the Malacoderma, which, "in the soft substance of their elytra, and their reticulations in some species of Lycus," seem to make an additional approach to the Orthoptera; these relations being regarded as of higher value than that of Staphylinus and Forficula, adopted by Mr. Stephens for the like purpose.

It is admitted, that there are numerous links wanting to complete many of these proposed passages; and it is also to be observed that it is only upon a consideration of the perfect state that these views have been founded; but at the same time it will be conceded, that if the difficult task of arranging the Coleoptera upon a review of the relations of the various groups be our object, these suggestions of Mr. Kirby will be entitled to great weight, from the evident justice upon which so many of them have been made.

3. *Pseudotetramera** (or Subpentamera, Tetramera *Latreille*, Cryptopentamera *Burm.*), in which the tarsi are 5-jointed, but the fourth joint is exceedingly diminutive, and concealed between the lobes of the preceding.
4. *Pseudotrimera* (or Subtetramera, Tetramera *Latr.*, Cryptotetramera *Burm.*), in which the tarsi are 4-jointed, the third joint being very diminutive, and concealed between the lobes of the preceding.

Sect. i. PENTAMERA.

It is observable that although Linnæus and Latreille considered very different groups as entitled to precedence amongst Beetles, by both Pentamerous insects were selected as fitted to commence the classification of the order; the former, probably influenced by their superior size and strength, employing the giant Lamellicorns for that purpose; and the latter, in consequence of the superior developement of the manducatory organs and their agility, together with their internal organization, giving the precedence to the predaceous Tyger-beetles† and Carabi. Mr. MacLeay, indeed, does not consider the latter insects as entitled to peculiar rank on these grounds; and, in fact, it only becomes a matter of importance with what insects we ought to commence our arrangements, when we have ascertained what are the precise animals composing the group immediately connected with or preceding them in a natural system, and by means of which the most easy passage between the two groups can be effected.

The section Pentamera seems to be divisible into two tribes, corresponding with Mr. MacLeay's groups Chilopodomorpha and Chilognathomorpha. I retain them, however, as merely provisional.

The tribe Chilopodomorpha, in like manner, seems to be divisible into two subtribes, viz.: —

1. The Adephaga *Clairville.*
2. The Rypophaga *Stephens.*

The former, constituting the more typical portion, is again divisible into

* I had elsewhere proposed the terms Subtetramera and Subtrimera for Latreille's Tetramera and Trimera; but as the preposition sub implies a deduction from the quality of the word to which it is prefixed, and as these two groups require, in effect, a designation implying a slight addition to the character originally imputed to them, I have proposed for them the terms of Pseudotetramera (or Subpentamera), and Pseudotrimera (or Subtetramera).

† See ante, p. 11. note *, p. 38. and Dahlbom, Clavis Nov. Hym. Syst. Præmon. p. iv.

two stirpes, Geodephaga and Hydradephaga, the insects being very predaceous in their habits; and the latter, or the aberrant portion, composed of three stirpes, Philhydrida, Necrophaga, and Brachelytra, and feeding upon dead animal or vegetable matter.

The circularity and natural progression of this tribe is effected, according to Mr. MacLeay, in the following manner: — Commencing with the Geodephaga we arrive at the Hydradephaga by means of Omophron, Hydrous in like manner connecting the latter stirps with the Philhydrida; whence, by the assistance of Helophorus, we arrive at the Necrophaga, which are united with the Brachelytra by means of Micropeplus; Lesteva, from its analogy with Lebia, and Stenus, from its analogy with Cicindela (as suggested by Mr. Kirby), forming the links which complete the circle, by uniting the latter stirps with the Geodephaga.

In the following pages I have adhered to this arrangement, although by introducing the Brachelytra at the end of the Necrophaga, the series of affinity between Dermestes, Anthrenus, Byrrhus, Hister, and Lucanus is broken.

The subtribe ADEPHAGA is distinguished by the outer lobe of the maxillæ being distinct and articulated, or palpiform*, so that these insects have been ordinarily stated to possess six palpi, one pair being attached to the lower lip, and a pair to each of the maxillæ, as though the gluttony of these insects required an additional organ. The inner edge of their lower jaws is also armed with strong spines along its entire length, the extremity being also terminated by an acute hook. The antennæ are long and slender, the legs of more than ordinary length, and the anterior tarsi generally dilated in the males. The variations occurring in this last-mentioned character have been employed by the French entomologists to distinguish several of the groups comprising this subtribe, but it is to Mr. Kirby that we are indebted for the most satisfactory remarks upon them. (*Faun. Bor. Amer.* p. 1.) In this respect, the Adephaga may be divided into — 1. Those without dilatation; 2. Those having the two anterior tarsi dilated; 3. Those which have the four anterior tarsi dilated. Instances of simple tarsi in both sexes occur in Manticora, the Scaritides, many Carabides, and some Brachinides, with Haliplus; on the other hand, in some Cicindelidæ, Colliuris, &c., and in certain Brachinides, the tarsi are dilated

* It is to Knoch (and not to Latreille nor MacLeay) that we are indebted for the first intimation of the true nature of this organ.

in both sexes. The Bimani (Dimani *K.*), or those with the two anterior tarsi of the males dilated, are most numerous amongst the Geodephaga, and exist also in Hydaticus and Acilius, whilst the Quadrimani are more numerous in the Hydradephaga, and also in the subfamily Harpalides. The number of dilated joints varies from one to four, the basal joint exhibiting the greatest degree of dilatation. There is also considerable variation in the form of the dilated joints, and which (as in the Patellimani) has been employed to characterise divisions. An equally important character exists in the lining of the sole of these dilated joints, which Mr. Kirby describes (without being apparently acquainted with the observations of Messrs. L. Dufour and Audouin, subsequently alluded to), and divides the Adephaga into three sections thereupon, namely: —

1. Sarrothropoda, or those with the dilated joints clothed beneath with a dense brush of stiff hairs: Cicindelidæ, Carabides, Chlænius and its allies. (See also *Aud. and Brullé, Hist. Nat. Ins. Col.* vol. i. p. 395. and 444.) Others have only a few hairs at the sides of the joints of the tarsi.
2. Cystopoda, or those with the foot-cushions formed of little membraneous vesicles or cysts variously arranged: Brachinus, Agonum, and various Harpalides. In Helluo and Anthia the dilated joints are furnished with lateral brushes, and in the middle with vesicles.
3. Pyxidiopoda, or those with the foot-cushions formed of pedunculated cups or suckers: Dyticidæ.

In the figures accompanying the various groups of Adephaga, I have illustrated the variations in these foot-cushions, which will thence be seen to be more numerous than stated by Mr. Kirby.

These insects are extremely active, and eminently predaceous, devouring other insects with great avidity, and occasionally not even sparing their own species. This subtribe is divisible into two* stirpes, according to the element in which the insects reside—

The 1st, Geodephaga, being terrestrial
The 2d, Hydradephaga, being aquatic } in their habits.

The former very far exceeds the latter in the number of its species.

* Mr. Kirby (*Faun. Bor. Am.* p. 6.) has proposed another stirps, *Hygradephaga*, for those Carabideous insects delighting in humid places (the *Acutipalpi*, *Subulipalpi*, and Elaphridæ), constituting an intermediate or transition group between the Geodephaga and Hydradephaga. I cannot, however, find any decisive characters for such a separation of insects so closely allied together as the Acutipalpi, &c., and the other Geodephaga.

The first stirps, GEODEPHAGA, or predaceous Land-beetles, have the legs long and formed for running, the four posterior being placed at equal distances apart, and capable both of vertical and horizontal motion; the jaws are long, horny, and curved, not being concealed by the upper lip; the terminal internal lobe of the maxillæ is straight, except at the tip, which is hooked; the antennæ are long and slender; the body is generally oblong, seldom oval; and the eyes prominent. This is one of the most extensive groups of insects; Dejean enumerating 2500 species, and Stephens describing about 450 as inhabitants of this country. From their numbers, therefore, they must be eminently serviceable in keeping in check the tribes of other insects which, if undisturbed, might become noxious. They are chiefly found beneath stones, under clods of earth, &c.

This stirps corresponds with the Linnæan genera Cicindela and Carabus, which appear to constitute the two chief divisions of the stirps. Mr. MacLeay has indeed divided the Carabi into four groups, and Mr. Stephens into six, each of which is considered of equal rank with Cicindela. Messrs. Kirby and Spence, however, follow Linnæus and Latreille, adopting only two chief divisions, proposing for Cicindela the name of Eupterina (in allusion to their powers of flight), and for Carabus that of Eupodina (from their power of running). I however prefer regarding these two divisions as families, and of equal rank: —

1st, Cicindelidæ, or Tiger-beetles (maxillæ armed with a moveable claw).

2d, Carabidæ, or Ground-beetles (maxillæ not armed with a moveable claw).

THE first family, CICINDELIDÆ *Leach**, is distinguished by the terminal hook of the maxillæ being articulated at its base (*fig.* 1. 3.):

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* BIBLIOGR. REFERENCES TO THE CICINDELIDÆ.

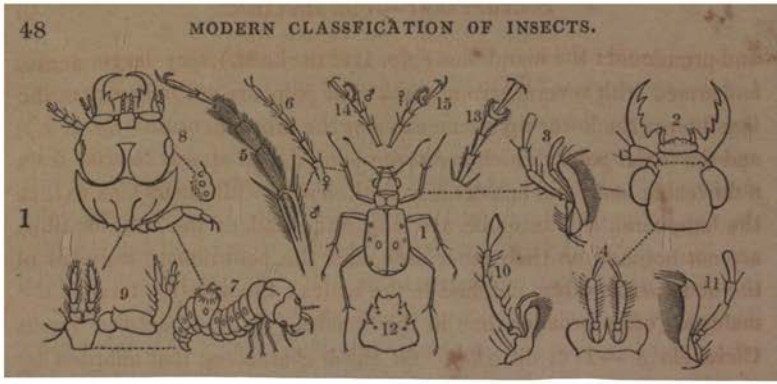
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the head is large, and broader than the thorax (*fig.* 1. 1. Cicindela campestris, the common green Tiger-beetle): the eyes are very large

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Thunberg. Museum Upsaliense, p. 51, 52. (Cicind. Cap. Bon. Sp.)
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Kollar, in Annal. Weiner Mus. der Naturgesch, b. 1. 1837.
And the general works of Fabricius, Olivier, Herbst. &c.

and prominent: the mandibles (*fig.* 1. 2. the head,) very large, acute, and armed with several strong teeth: the palpi are not longer than the mandibles: the lower lip is concealed by the broad mentum (*fig.* 1. 4.); and the labial palpi (which are three-jointed, and appear to arise from a moveable base, and are densely clothed with white hairs), as well as the legs, tarsi, and antennæ, are long and slender: the anterior tibiæ are not notched on their inner side, and the penultimate segment of the abdomen is often notched in the males: the anterior tarsi of the males are often broader than in the females (*fig.* 1. 5., anterior tarsus Cicindela ♂ — 1. 6. ditto ♀). Of these characters, that afforded by the slight development of the labium is, perhaps, the most valuable, although that of the articulated terminal maxillary hook has been chiefly relied upon; but M. Audouin has recently observed, not only that in the genus Ctenostoma the hook is entirely wanting—as, indeed, I had previously noticed by dissection (*fig.* 1. 10.)—but also that, in the Carabideous genus Trigonodactyla, the hook is distinctly articulated. In the genus Stenocera *Brullé* (Pogonostoma *Klug*), the hook is also wanting.

The Cicindelidæ generally frequent hot sandy districts, where they may be observed flying in the sunshine with great velocity; whence Messrs. Kirby and Spence have termed them Eupterina. Their flight is, however, of short duration; but they immediately take wing again on our approaching them. From the brilliancy of their colours they have been termed sparklers, whilst the name of Tiger-beetles has also been conferred upon them, not only from the spots and stripes with which they are ornamented, but also from their savage propensities, preying upon every insect which they can overcome, their extreme agility at the same time rendering escape impossible to their luckless prey. In the warmer climates of the New World some of the species of Cicindela, Iresia, Euprosopus, &c., appear to lose some of the habits of their congeners of more moderate climes; since it is upon the leaves and trunks of trees that they are generally found, where, like their terrestrial relatives, they carry on a ferocious war against other insects; flying from leaf to leaf with the agility of flies, and darting upon their prey with great quickness: some, however, make less use of their wings, running rather than flying, and seeking the most arid spots of ground for their abode.

The only larvæ hitherto observed in this family are those of several species of the genus Cicindela. Geoffroy (*Hist. des Insectes*, vol. i.),

Desmarets (*Bull. Soc. Phil.*, 1801—1805, No.190.), Ratzeburg (*Forst. Ins.* 1837. pl. 1.), Latreille (*Nouv. Dict. d'Hist. Nat.* 2d ed., &c.), and Messrs. Kirby and Spence (*Introd.*, vol. iii. pl. 17. f. 13.), have given accounts and figures of these larvæ; and in the *Annales des Sciences Naturelles* for March 1831, in a Memoir by myself, containing a detailed account of the habits of the insects of this family, both in the preparatory and perfect states, I have minutely described the structure of these larvæ, which in Cicindela campestris are long, subcylindric, and of a whitish colour and of a fleshy consistence (*fig.* 1. 7.); the head (*fig.* 1. 8. head and prothorax seen beneath) is very large, obscurely coloured, horny and hollow above, with a pair of large and powerful, sickle-shaped jaws, two short 4-jointed antennæ, and, as it appeared to me, six small simple eyes. The maxilla and labium are represented at *fig.* 1. 9. The first segment of the body is also horny, flat, and of a semilunar form, being, as is also each of the two following segments, furnished with a pair of strong articulated legs. The eighth segment of the body is the largest, and is armed with a pair of bent hooks placed upon a fleshy retractile tubercle. The four remaining segments are narrowed and terminated by a conical anal process. These larvæ burrow cylindric retreats in the earth to the depth of a foot or more, employing their legs and jaws in loosening the particles of sand and earth which they carry to the surface upon their broad saucer-like head, ascending by the assistance of the two hooks upon the back, somewhat after the fashion of a sweep going up a chimney. Having completed this burrow, they station themselves by means of their legs and dorsal hooks, at its mouth, their large flattened head and first segment fitting the hole; here they lay in wait for such insects as may be crawling about, seizing them with their jaws, by suddenly throwing the head backwards and then dragging them to the bottom of the burrow where they may generally be found in the position represented in *fig.* 1. 7. At the least approach of danger they also immediately slide down to the bottom of their retreats. When ready to assume the pupa state, it is stated that they close the aperture of the cells. Mr. Curtis (*Brit. Ent.* No. 1. 2d ed.) has suggested that the hooks on the back of the larva "may, by being brought into contact with the head, enable it to hold its prey." This, however, I conceive can scarcely be correct, since, at the period when the larva seizes its prey, its hooks are employed like anchors, to support it at the mouth of the burrow. Moreover, in the larvæ which I

kept alive, I never saw these organs employed in the manner suggested by Mr. Curtis, although I repeatedly saw them seize their prey. Nothing is known respecting the transformation of the exotic species of this family; Latreille, however, considers that they are similar to those of the European ones, neither have the pupæ been observed.

Respecting the name given to this group of insects, it is to be observed that our Latin dictionaries, and Cowper's pretty poem, *Ad Cicindelam*, supported by the authority of Mouffet (*Theatr. Ins.* cap. xv. *De Cicindela*), and some others of the old entomologists, would lead the entomological tyro to suppose that the Glow-worm was the insect under consideration. Such, however, is not the case; Linnæus, who at first described that insect as a species of Cantharis, having with evident impropriety applied the name of Cicindela to the Tiger-beetles. Geoffroy, however, erroneously considering the latter as not even generically distinct from the Linnæan Carabi (which he regarded as the Buprestis of the ancients), improperly gave the name of Cicindela to the Soldier-beetles (*Telephorus*, or the Cantharides of Linnæus), applying at the same time the name of Cantharis to the Blister-fly (Canth. vesicatoria), and to the Glow-worm, the old Greek name of Lampyris. In the subsequent editions of the Systema Naturæ, Linnæus adopted the latter alteration, and the Glow-worm is now known by the name of Lampyris; but for the Tiger-beetles, which he correctly considered as distinct from the Carabi, he still retained the name of Cicindela, which, notwithstanding its evident impropriety, has been universally adopted. The Soldier-beetles, he named *Cantharis*, and the real Cantharis of the shops or Blister-fly he called a *Meloe*, whilst to complete the confusion Fabricius considered the Blister-fly as distinct from Meloe, and gave it the name of Lytta. Such is one of the instances (of which it is to be regretted that too many are to be found in the works of the earlier entomological nomenclaturists) of that want of unity which has resulted from the great deficiency of some fixed rules of nomenclature in Natural History. In the instances before us, this confusion still exists; for although the two insects which gave rise to it, the Tiger-beetle and the Glow-worm, have at length by general scientific usage acquired a title to the names of Cicindela and Lampyris, modern entomologists are still at issue respecting the names of the Blister-fly and the Soldier-beetle, the former being called by some of the most recent authors (Dejean, Gyllenhall, &c.,) Lytta; and by others (Latreille,

Stephens, &c.) Cantharis; whilst the Soldier-beetles are by some writers termed Telephorus, and by others Cantharis.

The number of insects belonging to this family scarcely exceeds 250 (or one tenth of the family Carabidæ*); of these by far the greater portion are exotic, and the Baron Dejean has described about 200 of them as belonging to the genus Cicindela. They are generally of a moderate size, the majority varying from half an inch to an inch in length: none are beneath one third of an inch long; their forms, as well as the disposition of their colouring, are generally very elegant.

The affinities of these insects with the Carabidæ are very varied and interesting; thus whilst Manticora and Anthia (as indicated by Latreille, *Col. d'Eur.* No. 1.) are strikingly allied together, Elaphrus seems not less nearly to approach Cicindela. In like manner Colliuris *Latr.* closely resembles some of the genera of the Brachinides, especially Colliuris *De G.* (Casnonia *Latr.*), and Agra (see *Kirby, Faun. Amer. Bor.* p. 5.); and M. Audouin has lately placed Trigonodactyla (one of the Brachinideous genera) at the head of the Carabidæ, from the identity of structure of its maxillæ and those of the Cicindelidæ. Mr. MacLeay also appears to consider that the Cicindelidæ and typical Carabidæ are allied, from the identity in the unnotched anterior tibiæ. From these varied points of affinity of the Cicindelidæ with the various divisions of the Carabidæ, it is impossible to arrange them in a series, or to describe them in the order in which they are arranged by nature. A more distant relation of the Cicindelidæ with the Brachelytra, by means of Stenus has been suggested by Mr. Kirby (*Fauna Bor. Amer.*).

Several modes of distribution of the genera of this family have been proposed by Latreille, MacLeay, Brullé, &c.†; but these authors have chiefly selected isolated organs, and as the genera are entirely

* It is a remarkable circumstance in the distribution of insects, that whilst some families abound in species, such, for instance, as the Carabidæ, &c. others intimately allied to them, as the Cicindelidæ and Dyticidæ, possess but very few. The same observation may be made of generic groups: thus, Dejean enumerates 163 species of Carabus, whilst of the more widely distributed allied group, Calosoma, he only describes 28.

† Mr. Kirby divides the family into Longicollia (Colliuris), Brevicollia (Cicindela), Fissicollia (Manticora), forming them into a circle with some of the Brachinides, namely, Agra as the counterpart of Colliuris, Anthia of Manticora, and Calleida of Cicindela. These Brachinideous genera appear, however, to me to be in this manner unnaturally separated from their legitimate allies, the remainder of the Brachinideous group.

exotic, with the exception of Cicindela, which is the only British, and, indeed, European, genus, the discussion of these arrangements may be here dispensed with.

The species of the G. Cicindela are generally of a green or bronzed colour, ornamented with white spots and streaks upon the elytra.* The typical species C. campestris *Linn.* the common green tyger-beetle (*fig.* 1. 1.) is by far the most abundant species in this country, being generally distributed throughout England. It is rather more than half an inch long, of a deadened green colour, with several white spots on the elytra, varying in number from three to six; the upper lip also is white; the female has also two additional spots, but of a dusky colour, near the base of the elytra. I have found this species as early as the middle of February at Coombe Wood, and have noticed, that when handled, it exhales a pleasing scent, something like that of roses. Messrs. Kirby and Spence have observed, respecting another British species (Cic. sylvatica *Linn.*), that it flies with a considerable humming noise.

Another species of this genus, which has only recently been ascertained to be indigenous, is the true Cicindela hybrida of Linnæus, respecting which great confusion exists in modern entomological works. See Stephens (*Illust. Brit. Ent.* vol. i. pp. 8. 18. 175. and vol. v. p. 366.); Curtis (*Brit. Ent.* No. 1. second edition); Audouin and Brullé (*Hist. Nat. Ins. Coleopt.* 1. livr. 1.). Laporte (*Silberm. Rev. Ent.* No. 7. and *Hist. Nat. An. Artic.*); Klug. (*Iahrbucher*, 1834); Erichson (*Kafer Mark Brandb.*). I am therefore happy in being able to clear up the doubts which have been raised, by giving a figure from the specimen of this species, preserved in the Collection of Linnæus, now in the possession of the Linnæan Society. The insect attached to the label of *Cic. hybrida*, in the handwriting of Linnæus himself, is that to which the French entomologists have assigned (but doubtingly) that name, and which Mr. Stephens has described under the name of Riparia. Moreover the Linnæan Cabinet does not contain a specimen of the species which Mr. Sowerby figured

* M. Audouin has taken occasion, in describing a beautiful species of Cicindela from the East Indies, ornamented with golden yellow spots, to make some observations upon the general uniformity and prevalence of particular colours in particular groups of animals, giving the Cicindelæ as an example; the species under description of course forming an exception to their prevailing hue. — Guérin, *Mag. Zool. Ins.* pl. 18.

under the name of Hybrida, and which has been described by the French authors under that of C. maritima.

The smallest British species is the C. Germanica *Linn.*, which is only five lines long, of a dark green colour with four small spots, and a terminal lunule of a white colour on the elytra. It has been found in great abundance at Blackgang Chine in the Isle of Wight, and elsewhere; and instead of frequenting hot sandy places, like the other species, it is observed running amongst grass and low herbage in moist situations. It has also been observed, that it makes but little use of its wings: this, and some other circumstances, induced me to suggest the establishment of a subgenus (named Cylindera, from its cylindric neck), for the reception of it, and some allied species; in the majority of its structural characters, however, it agrees with the common species.

Some of the exotic species of the genus Cicindela are generally found upon the leaves of trees (Westermann in *Silberm. Rev. Ent.* No. 3.; *Lacordaire, Annales Sci. Nat.*, June, 1830, &c.). These species have been separated by M. Laporte, under the name of Odontocheila: they are of a narrower form than the other species, and have the upper lip more advanced and toothed; M. Brullé, moreover, having examined the structure of these tree insects, discovered that in some of them the anterior tarsi are channelled down the centre beneath, whilst some have a style or bristle at the tip of the internal maxillary palpi; but these characters, not being permanent throughout the group, he is induced to regard them as merely indicative of a sectional division, of which the Cic. cylindricollis, Cayennensis, &c. are examples. The Cic. nodicornis *Dej.* also belongs to the same group, but is distinguished by the curious structure of the antennæ of the males, which have the basal joint terminated in a thick knob.

We are informed by M. Chevrolat, that the Mexican species, Cic. curvata, burrows in moist sand, whenever the wind blows or the sun is obscured, and that the natives macerate it in water or spirit of wine to prepare a medicinal liquid (*Silberm. Rev. Ent.*, No. 6.). According to M. Westermann, the Cic. 6-pustulata, bicolor, and 20-punctata are found upon the young rice plants in the East Indies (*Silb. Rev. Ent.* No. 3.). Mr. W. W. Saunders has published an account of the first of these three species, as well as of another new species, which he has termed Cic. limosa, which he observed near Calcutta, and which are attracted by the light of lamps entering apartments,

or even ships lying at anchor by night, thus totally differing from their European brethren (*Trans. Ent. Soc.* London. No. 1.). M. Guerin has figured a remarkable species from Cochin China, in his *Iconographie*, in which the legs are excessively long and slender; and M. Barthelemy has described and figured another curious species (*Cic. Audouinii*) from the coast of Barbary, in which the last joints of the antennæ are much thicker than the rest (*Ann. Soc. Ent. France*, 1835, pl. 17. f. 1.). The species had, however, been previously described by Mr. Vigors in the *Zool. Journ.*, under the name of C. Ritchii. It forms the genus Laphra, in Dejean's new catalogue.

The largest insects in the family belong to the genus Manticora, of which the type is the M. tuberculata *De G.* (maxillosa *Fabr.*). It is about two inches long, an inhabitant of the arid sandy plains of Southern Africa, entirely of a black colour, and destitute of wings, the elytra being soldered together: hence the insect is confined to the ground; it runs with great agility, and secretes itself under stones. Mr. G. R. Waterhouse has described a second species of the genus (M. latipennis) brought from the interior of Southern Africa by Dr. Andrew Smith, by whom it was discovered in a clump of dead trees (*Mag. Nat. Hist.* Sept. 1837). Other genera (Ctenostoma, Aptema, Dromica, Platychile) are also apterous, or furnished only with rudiments of wings. The species of Megacephala, also owing to the great length of their legs, and their somewhat less developed wings, are more accustomed to running than flying than the other winged species of the family; and according to M. Lacordaire, Meg. sepulchralis makes no use of its wings, but runs with great agility through the grass growing in sandy situations in the forests of Brazil. This species emits a strong smell of roses, but which shortly after death becomes fetid and disagreeable.* Another Brazilian species of the same genus hides itself beneath dry dung in the burrows of the Onthophagi and Coprides, where it remains during the heat of the day, endeavouring to defend the mouth of its hole, if an attempt be made to drag it forth. If this be persisted in, the insect soon descends to the bottom of its burrow, whence it may be drawn in the same manner as the larva of our common species, by introducing a straw, which it immediately seizes, and will then allow itself to be drawn up forcibly, rather than

* This species differs so materially from the other species of the genus in its produced labrum and short antennæ, as to require a distinct subgenus for its reception.

let go its hold. According to Olivier and Lacordaire, the insects of this genus make a noise somewhat like a grasshopper, by rubbing the hind thighs against the margins of the elytra. M. Laporte has published a monograph upon this genus in Silbermann's *Revue Entomologique*, No. 7. Another of the exotic genera, Oxycheila *Dej.*, is distinguished by having the upper lip very long, pointed in front and notched at the sides. According to M. Lacordaire, the species of this genus fly more heavily and run slower than the Cicindelæ, and hide themselves under stones during the heat of the day: they also emit an acute sound when handled, by rubbing the posterior femora against the elytra, as does also the species of which the genus *Euprosopus* is composed. The upper lip is also greatly developed in my genus Distipsidera (*fig.* 1. 12.).

The genus *Therates* Latr. (Eurychile *Bonelli*) is remarkable in having the internal maxillary palpi rudimental (*fig.* 1. 11.) and the tarsi with the penultimate joint dilated and heart-shaped (*fig.* 1. 13.). From this circumstance Bonelli (who had made the interesting observation, that in general those insects which creep upon the ground have simple tarsi, whilst in those which frequent plants they are more or less dilated,) was led to suppose, that the Therates seeks its prey upon plants in the same manner as the Calosoma. I have, however, elsewhere shown, that in this family, at least, such an observation does not entirely prevail (*Annales Sc. Nat.*): the genera Euprosopus and Iresia, for instance, which are known to be tree insects, have the tarsi, even in the males, but slightly dilated, as is indeed the case in Calosoma, whilst some of the apterous, and consequently terrestrial species in the family (Tricondyla, Ctenostoma,) have the anterior tarsi in the males greatly dilated. The structure of the tarsi is very different between those insects in which the dilatation is merely sexual, and confined to the fore legs, and the true herbivorous Coleopterous insects, in which all the tarsi in both sexes are dilated and cushioned, and which is also the case even in the genus Collyris (*fig.* 1. 14. anterior tarsus, ♂. 1. 15. ditto ♀.). Of the exotic genera, Collyris *Fabr.* (Colliuris *Latr.*) Tricondyla, Therates, Procephala, and Ctenostoma are distinguished by their very narrow form, and by their thorax, which is globose in the middle. Of the last named genus I have published a detailed account in the *Zoological Journal*, No. 17. The Brazilian genus Iresia is distinguished from all the other genera by having the terminal joint of the labial palpi longer than the penultimate. The

genus Stenocera *Brullé* (Pogonostoma *Klug.*) is confined to Madagascar, and is remarkable for the great length of the antennæ, palpi and legs, and the cylindrical body.

The second group of predacious land Beetles or the family CARABIDÆ Leach*, comprises the entire genus Carabus of Linnæus with a

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few of his species of Cicindela. This is a family of very great extent, 2250 species having been described by Dejean, which are contained in his own collection, and their are numbers which he does not possess. It is a family which has attracted much of the attention of modern entomologists, Clairville, Bonelli, Paykull, Dejean, Leach, Latreille, &c., being amongst those whose investigations have been directed to its elucidation; hence, the structure of the perfect insects has in a great degree become well known: few observations have, however, been made relative to the natural history of the various species.

This family is at once distinguished from the Tiger-beetles by the maxillæ terminating in a simple point without any articulation at

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the tip* (*fig.* 3. 2., 4. 14. 16. 18.). The lower lip is more or less developed, generally square, and sometimes with a short tooth on each side in front† (*fig.* 3. 4. 4. 19.). The mentum, or horny basal portion (*fig.* 3. 3. *fig.* 4. 8. 19.) is advanced into corneous lobes at the sides, the centre of the emargination being either simple, or furnished with an entire or bifid tooth. The mentum in some few species (Enceladus, Silphomorpha *Westw.*) is soldered to the under side of the skull. The head (*fig.* 3. 1. head of Omaseus melanarius) is generally narrower than the thorax, the eyes but slightly prominent, and the various parts of the mouth are considerably advanced in front; the upper jaws are very powerful and hooked at the tip, but they are destitute of teeth or have them very short; the labial palpi (*fig.* 3. 4.) are 4-jointed; the basal joint is, however, soldered to the lip, merely forming a support to the three terminal joints. The palpi are generally longer than the mandibles (*fig.* 4. 1. 11.), and smooth or but slightly clothed with bristles. The body is oblong, rarely ovate, and the posterior legs have a vertical as well as a horizontal motion, the pectoral laminæ (coxæ) to which they are attached, being small (*fig.* 4. 9.). Mr. Kirby has observed that in all those species which have the anterior tibiæ notched (with the exception of those which have the elytra distinguished by elevated ridges) there is usually a series of from twelve to thirty ocellated impressions near the lateral margins of the elytra on the 8th, or between it and the 9th furrow: these impression, but not ocellated, also exist in Cicindela; the typical number of furrows is nine, but in Omophron and some others there are fifteen (*Faun. Bor. Amer.* p. 7.) *Fig.* 3. 6. represents an elytron of Omaseus melanarius. Many species are furnished merely with rudimental wings: these, however, in some instances are fully developed in certain specimens of the same species; occasionally also the elytra are soldered together, whence these insects are distinguished from the Cicindelidæ, which are especially fliers, by their great activity and running powers, and whence they have been termed by Messrs. Kirby and Spence, Eupodina.

The body of these insects is of a very firm consistence, whereby they are enabled to creep about under stones, &c., as well as

* In the genus Trigonodactyla, as has been observed by M. Audouin, the maxillæ are terminated by an articulated hook.

† These lateral appendages, or paraglossæ, as they have been termed, have been generally considered to be portions of the lip itself; such, however, is not the case, as they are evidently the exserted margins of the internal lingua or tongue (*fig.* 3. 4, 5.).

prevented from falling beneath the power of the insects which they attack; most of the species of this family being eminently insectivorous, prowling about on the surface of the ground, under stones, &c., or beneath the bark of trees, or in the moss growing at the roots of the latter, in search of their prey, which consists of larvæ, or of herbivorous beetles and other insects, sometimes even attacking their own species. Latreille in like manner informs us (*Histoire Générale*, &c., vol. viii. p. 374.), that the Scarites gigas burrows into the earth under cow-dung in sandy places by the assistance of its anterior palmated fore legs, which singular habitat appears to be accounted for by the circumstance, also stated by him, that when confined with some of the stercoracious lamellicorn Beetles (Heliocantharus sacer, &c.), they pull them in pieces and devour them; and M. Lefebvre de Cerisy, who has published some observations upon the same species, informs us that they are nocturnal insects of prey remaining in their retreats during the day, but sallying forth at night and preying upon such Melolonthæ, &c., as fall in their way. These latter insects seem indeed to be a favourite food of the Carabidæ in general, for the former author elsewhere states that the chief nourishment of the true Carabi consists of the larvæ of insects and of herbivorous beetles, such as Cockchafers, Rosechafers, &c., which, as Mr. Dillwyn also observes, they certainly prefer (*Memoranda*, p. 56.) Latreille adds that the beautiful Carabus auratus, which is probably thence termed in France "Le Jardinier," devours more cockchafers than all the other enemies of these destructive insects by attacking and killing the females at the period of oviposition, and thus preventing the birth of thousands of young larvæ. These insects are therefore of essential service in keeping down the numbers of noxious insects with which our gardens and pastures might otherwise be overrun. It has been suggested to me by a celebrated zoologist, that the carnivorous quadrupeds which are the analogies of the predacious land beetles, in like manner prey upon herbivorous quadrupeds.*

* The anterior tibiæ of a great number of the species are deeply notched near the tip, on the inside; and Mr. Curtis has noticed an interesting peculiarity of structure in the anterior tibiæ of the genus Cillenum, which are not only armed with the two ordinary spurs (one above and the other below this notch), but have, also, two additional deflexed spines at the outer extremity of the notch, between which spines he presumes the lower moveable spur is received: hence he conceives that these notched anterior legs of the Carabidæ are used in seizing and retaining their prey, for the limb of an insect being received into the notch, and the lower

The habits of the family are not, however, exclusively carnivorous, since some of the species generally found in cornfields are clearly ascertained to feed upon growing grain; thus Nicolai observes respecting Broscus cephalotes "in agris occurrit frumenti vastator *videtur, certe* ejus larva." (*Dissert. Inaugural. &c. Halæ*, 1822, p. 12.) Latreille also says "J'ai vu souvent *l'aristus bucephalus* grimper sur des graminées en arracher les bales et les emporter avec ses mandibules." (*Règne Animal*, vol. iii. 1st ed. p. 190.): hence, he was induced in the *Coléoptères d'Europe*, to consider that the Scaritides were less carnivorous than the other Carabidæ. Its larva, however, resembles that of the Cicindelæ, both in form and habits; and as the carnivorous habits of another of the Scaritides had been previously observed upon by him as above mentioned, it seems not improbable that the circumstance noticed, of the Aristus thus feeding upon grains, was accidental. The larvæ of Zabrus gibbus (*fig.* 2. 6.) also, upon the authority of Germar and other German naturalists (*Magaz. der Entomol.* vol. i.), which are produced from numerous clusters of eggs a short time previously deposited by the females, feed during the night upon the young shoots of wheat, occasionally doing great mischief, as in the instance recorded by Germar, where 230 acres of wheat in the canton of Seeburg, near Halle, were destroyed by it. During the day these larvæ were observed to bury themselves in the earth several inches deep; they remained about three years in this state, and attained their full size in June, when they formed for themselves an oval cavity in the earth, sometimes two feet deep, in which they became pupæ, appearing in the perfect state at the end of a month, when they resumed their destructive habits by climbing up the stalks and feeding upon the grain. When confined in a box in which several ears of corn had been placed, they first fed upon the grains; and when they had consumed the whole, they then attacked each

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moveable spur being then pressed upon it, the insect would be effectually secured, whilst the spurs of the posterior legs are supposed to be employed in securing a firm footing upon the objects they wish to destroy or tear to pieces. The former of these suppositions is probably correct; indeed, a direct observation in support of it will be found in the account of the Cantharidæ: the latter, however, is probably, less correct, since many insects, which have the spurs of the hind legs much developed, are remarkable for their leaping and shuffling kind of motion, as Orchesia, Platyura, &c. I imagine that the claws alone are employed in retaining hold of objects by insects whose tarsi are simple.

other. These larvæ were accompanied, in the proportion of about one fourth by the grubs of the Melolontha ruficornis *Fab.* which, from belonging to a group of insects eminently destructive to the roots of vegetables, must have augmented the mischief. Messrs. Curtis and Stephens have, indeed, doubted whether any portion of the injury is attributable to the Zabrus, the latter author considering that it might rather have been entirely caused by the grubs of the chaffer, and that the larvæ of the Zabrus (belonging to a decidedly carnivorous group) contributed to lessen the damage by devouring the other larvæ whilst the perfect insect ascended the corn for the purpose of feeding upon the insect parasites thereon, and hence questioning whether the destruction of the Zabri would be desirable. The opinion of Mr. Stephens (*Illust. Brit. Ent. Mandib.* i. 140.) was adopted also by Messrs. Audouin and Brullé in their first volume. Contrary, however, to these opinions, we have the express statements of Germar and Kollar (*Naturg. Sch. Ins.*): the circumstance of the imago eating the grain when confined, the comparative paucity of the grubs of the chaffer, whence it would happen, were the larvæ of the Zabri really carnivorous, that they would be unable to find sufficient food to supply their ravenous appetites; moreover, the grubs of the chaffer are subterraneous, whilst it is stated that the young growing shoots were devoured, and lastly, the circumstance that the perfect Zabri are constantly found in cornfields and even upon the ears of corn, crawling up the stems or hovering upon the wing just above the heads of the corn, as Mr. Vigors has informed me that both sexes may occasionally be observed. The question, however, has been set at rest, at least as regards the perfect insect by the Rev. G. T. Rudd, who has stated to me that he and a friend distinctly perceived several specimens of Zabrus upon the ears of corn, opening the husks and extracting and devouring the grain. He has subsequently published an account of this circumstance in the *Entomological Magazine*, vol. ii. p. 182.*

I have in like manner noticed several of the large black species of Harpalides running about pathways near cornfields, especially in the evening, and creeping from amongst the standing wheat, where it is probable that they have been feeding during the day: their appearance

* Messrs. Audouin and Brullé, in the fifth volume of their work upon the Coleoptera, adopted this opinion, being contrary to that which they had entertained in the fourth volume of their work. Mr. Tulk has also informed me, that he has kept several Zabri alive, for many months, feeding them upon grain.

in the evening, although it certainly bespeaks a predacious disposition, does not disprove their herbivorous habits during the day. I have also occasionally observed several of the metallic-coloured species of Harpali, Amaræ, &c., amongst the upper branches of umbelliferous and other plants during the autumnal months, where it is not improbable that they ascended for the purpose of feeding upon the ripe seed. M. Zimmermann, in a valuable memoir upon the genus Amara has published an account of their habits, from which it appears that vegetable substances form their chief support; they feed upon the pith and stems of gramineæ, succulent roots, and likewise upon the larvæ of other insects which they can master; they eat much, as may be seen from the swelling of the abdomen. Hence, as Messrs. Audouin and Brullé (v. p. 29.) observe, this genus, together with the Zabri, compose a group of herbivorous species amongst the carnivorous family to which they belong. Signor Passerini has also published a Memoir upon the ravages occasioned to young wheat by the larvæ of Zabrus gibbus and Calathus latus.

Some of the Harpalides, as we are informed by the Rev. Mr. Bird, not only fly by night, but are attracted to the light of a lamp, sometimes in great numbers. (*Entomol. Magaz.* ii. 41.) Mr. G. R. Waterhouse has also informed me that a specimen of Harpalus ruficornis flew into his chamber in which a light was placed, a short time previous to a storm; hence it is evident, not only that these insects seek their prey by night, but that their flight is high, and that they are subject to the same influence arising from lights as moths. Mr. Curtis has also recorded a similar circumstance respecting Harpalus griseus. The flight of the former insect, shortly previous to a storm, is also curious, as it is well known that many insects are peculiarly liable to be affected by sudden atmospherical changes.

Some of the species, especially the larger Carabides, exhale a fetid odour, discharging at the same time from the abdomen to a considerable distance a caustic and acrid fluid, whence some of them, as the Carabus auratus, already mentioned, have obtained the name of "Vinaigriers" in France; indeed, as in the instance recorded by De Geer, in which some of this fluid was discharged into the eyes of his friends, it is capable of producing very violent pain for several moments.* It is owing to the rapid volatilisation of this liquid, that the genus Brachinus makes the explosions subsequently described.

* See Dufour, Recherch. Anatom., p. 204.

In like manner Anchomenus prasinus (one of the Harpalides) is said to combat its enemies with repeated discharges of smoke and noise. (*K. and S.* ii. 247.) They also discharge a very acrid liquid of a black colour from the mouth, when captured or whilst eating, which produces similar effects on the skin to those caused by powdered cantharides; indeed, by the ancient physicians they were employed in medicine as being highly vesicatory, whence Geoffroy considered them to be the Buprestis of the ancients, which were accounted as a dangerous poison to cattle. Latreille, however, in a valuable memoir upon these poisonous insects in the tenth volume of the *Annales du Muséum*, has satisfactorily shown them to have belonged to the modern family Cantharidæ.

Olivier informs us that a sort of soap is made by the natives in some parts of Africa from a species of Carabus, to which he gave the specific name of Saponarius, belonging to the subfamily Harpalides; and from information given by M. Dumolin to Dejean, it appears that these insects are not employed in the manufacture as affording alkaline matter, as had been supposed, but for the fatty matter which is obtained from them.

The majority of the Carabidæ inhabit the elevated regions of the southern parts of Europe, Asia, and North America. The first of these quarters of the globe is, however, their chief metropolis, none other possessing so great a number of species. In England we scarcely possess more than 400 species. The insects composing the true genus Carabus disappear as we go either to the North, or towards the tropics, whilst the allied genus Calosoma is distributed over Europe, Africa, America, and New South Wales. The genus Pamborus is confined to the latter country, whilst Procerus and Procrustes are chiefly found in the countries bordering the northern shores of the Mediterranean Sea, where other equatorial genera begin to make their appearance. Some species are found upon the margins of streams or standing water, whilst some of the Carabi and Pterostichi, &c. are only found on the tops of the highest mountains. Again, many of the species of the Brachinides are generally found either upon the trunks or beneath the bark of trees.* These species are likewise more variegated in their colours and lest robust in their

* It is evidently owing to this circumstance that some of these insects are occasionally found embedded in gum anime, in which substance I have observed several beautiful species. (See also *Germar, Mag. Ent.* v. i. p. 13. G. Lebina.)

structure than the majority of the family. They are also characterised in many instances by having the tarsi dilated, and the penultimate joint more or less bilobed in both sexes, a peculiarity resulting, as Bonelli has observed (*Mem. Acad.* Turin, vol. xxiii.), from the situations in which they reside, this structure being in fact analogous to the cushioned feet of flies as well as of those of the true herbivorous Beetles. M. Lacordaire has confirmed these observations in his account of the habits of the Brazilian Coleoptera (*Ann. Sc. Nat.*, June, 1830).

The internal anatomy of the Carabidæ has been investigated by M. Dufour, in the *Annales des Sciences Naturelles*, for August, October, and December, 1824. Ramdohr also has published an account of the anatomy of Carabus monilis, in the *Magazin Gesellsch. Naturf. zu Berlin*, vol. i.; and Dr. Burmeister's *Memoir on the Anatomy of the Larva of Calosoma*, published in the *Transactions of the Entomological Society*, vol. i., must also be mentioned.

Few observations have hitherto been made relative to the *larvæ* of this family: this may indeed, perhaps, be partially accounted for, from the obscure situations in which they are found, and from the difficulty of rearing them. Those, however, which have been noticed, are equally voracious with the perfect insects, and are found in similar situations: they are generally long, with the body of equal breadth throughout, and the head of a moderate size, with the rudimental eyes equal; a scaly square prothorax, and with the eighth segment simple, and resembling the remaining joints: the terminal segment is, however, armed with two conical horny appendages, toothed in the Carabi and Calosomæ, but (according to Latreille, whose statement I am, however, inclined to doubt) long, fleshy, and articulated in the larvæ of the Harpali and Licini; in the latter, also, the body is shorter and the head larger. The part where the anus is situated is prolonged into a membranous deflexed tube, which serves as a support to the tail: the jaws resemble those of the perfect insect.

The larvæ of *Ditomus bucephalus*, however, according to Latreille (*Règne An.* second edit. t. iv. 190.), resemble those of the Cicindelæ, whilst that of *Omophron* decidedly approaches the form of those of the Water-beetles (Dyticidæ).

One of the most voracious larvæ in the family, is that of *Calosoma Sycophanta*, first described by Réaumur, in the third volume of his *Mémoires*. It is black, with six scaly legs: when full-grown it is

an inch and a half long, subdepressed and fleshy; the upper surface of each segment and the head are, however, more scaly; the tail is terminated by two horny spines, and the head is armed with two powerful jaws, wherewith it seizes the body of its struggling prey, which consists of the fleshy larvæ of Lepidoptera. As it is very ravenous, devouring several large Caterpillars in a day, it has the sagacity to find its way to the nests of the gregarious processionary Moths, in the midst of which it takes up its abode; and Réaumur states, that he never found a nest of these Caterpillars which was not infested with from one to six of these larvæ: here they feed in the midst of their prey (not even sparing them when they have become chrysalides), in so gluttonous a manner that the segments of the body become distended, and render it unfit for any movement, so that it becomes an easy prey to its young and more active brethren, which, in mere wantonness, seize it with their jaws, although surrounded by their natural food. All Réaumur's larvæ died before they became perfect insects; but there can be but little doubt, that they are the larvæ of the Calosomæ, of which, as Réaumur observes, the habits are precisely similar; indeed, Clairville, and the French entomologists, appear to entertain none upon this subject. And M. Boisgerard, in a communication made to M. Audouin (published by the latter, in the *Hist. Nat. Ins.* t. v. p. 94.), states, that having placed some female Calosomæ upon trees greatly infested with the Caterpillars of Bombyx Dispar, the larvæ of the Calosomæ were found in the following season in the nests of the Caterpillars, and that in the course of two or three years the trees were cleared. Dr. Burmeister has published a very elaborate account of the anatomy of the larvæ of Calosoma Sycophanta (which is not rare in the pine forests in the vicinity of Berlin, where, both in the larva and perfect state, it devours the Caterpillars of Bombyx Dispar, and other Moths,) in the first volume of the *Transactions of the Entom. Soc.* of London, illustrated with two plates. This larva does not confine itself to Lepidopterous Caterpillars, for Nicolai informs us, that it is occasionally found in some profusion, in the pine forests near Halle in Germany, devouring the larvæ of the Saw-fly of the pine, Lophyrus Pini. (*Dissert. Inaugural*, p. 13.)*

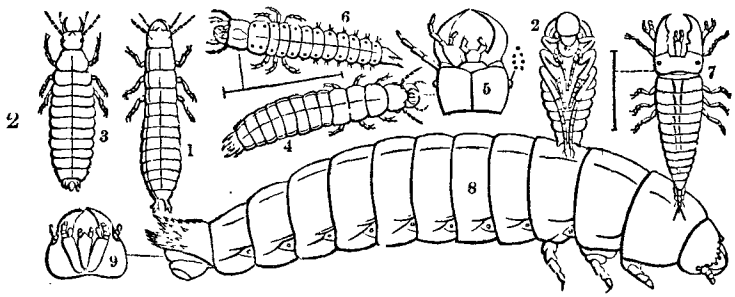
M. Audouin has also published (in the *Hist. Nat. Ins.* vol. v. p. 99.) an account of the larva of one of the largest European species of the

* Dr. Ratzeburg has given several very characteristic figures of this larva (as well as of that of Cicindela campestris) in his Forst. Insect. (pl. 1.), just published.

family, Procrustes coriaceus, found in France, and also, but very rarely, in England: the larva resembles that of the Calosoma; it is corneous, subcylindric, and terminated by two strong curved spines, each of which is furnished beneath with a smaller spine. It is about an inch and a quarter long, lives under moss and in damp situations, where it feeds upon snails and slugs. It is full grown in the spring, becomes a pupa at the beginning of May, in a cell which it forms in the ground, and remains in that state not more than a fortnight. The perfect insect also feeds upon snails.

Dr. Heer has described and figured the larvæ of the following species of Carabus and of Cychrus rostratus in his *Observationes Entomologicæ*, 1836.

The larva of Carabus auronitens (*fig.* 2. 1.) is very similar to that of



Calosoma in its general form, the mandibles sickle-shaped with a strong tooth inside at the base, and the terminal segment of the body armed on each side with a thick horny spine with a spur on each side. The antennæ are 4-jointed, as well as the maxillary palpi: the eyes are simple ocelli, there being six on each side. It was found on the 1st of June under a stone, and was transformed to the pupa on the 3d, and to the imago on the 15th of the same month. The pupa (*fig.* 2. 2.) is of an ordinary form, with the abdominal segments rounded at the sides, and furnished on each side with a fascicle of hairs; the anal segment is terminated by two conical appendages. The larvæ of Carabus depressus and C. hortensis are also very similar to the preceding, differing chiefly in the greater or less breadth of the abdominal segments, and in the greater elongation of the anal fork, which are simply setulose.

Clairville also states, that the larva of one of the species of the restricted genus *Carabus*, which he had noticed, precisely resembled that of *Calosoma*, figured by Réaumur.

Dr. Heer states, that the larva of Cychrus rostratus (*fig.* 3. 3.), "a Caraborum larvis capite parvulo, palporum articulis exterioribus crassioribus, mandibulis erectiusculis, et corporis forma breviori latiorique facile distinguitur;" in addition to which the prothorax is conical, and the anal segment very short, with the hinder angles prominent, and armed in the middle with two very short and simple spines.

De Geer has figured a larva (*Mémoires*, vol. v. pl. 12. f. 1—3.) closely resembling that of Calosoma, which was found in the ground, and which he presumes to be the larva of one of the species of this family. He was not, however, able to rear it.

In the first edition of the *Coléoptères d'Europe*, M. Latreille announced a memoir upon a larva sent to him by M. Westermann from Bengal, supposed to be that of *Anthia* 6-*guttata*. This larva, since the death of Latreille, has been described and figured by M. Lequien in his Monograph upon Anthia, published in M. Guerin's *Magasin de Zoologie, Insectes*, pl. 41., and by Messrs. Audouin and Brullé, in their *Histoire naturelle des Insectes*. It is nearly three inches and half long (*fig.* 2. 8.) with a subcylindric scaly body, consisting of twelve segments, exclusive of the head (*fig.* 2. 9. under side of head), which is armed with strong acute mandibles, very short three-jointed antennæ, and a single pair of eyes; the upper side of the head is rugose with several tubercles in front; the terminal segment is scabrose, serrated at the sides, with a deep notch at its extremity; this segment is furnished beneath with a single fleshy anal prœg. The second? and nine following segments are respectively furnished with a pair of lateral spiracles; the mentum and maxillæ are long and extend almost to the base of the head. The legs are short. This larva is of a black colour, with the posterior margins of the segments obscure red. It has not been stated upon what grounds this larva was considered as that of *Anthia* 6-*guttata*, and indeed upon comparing the details of its structure, and especially its trophi, with that of the known Carabideous larvæ, I have no doubt that it does not even belong to any of this family; since, in its general appearance and organisation, it approaches much nearer to the larvæ of the *Elateridæ*.*

* Since the above was written, I have received the following communication from M. Westermann himself, relating to this larva, in answer to the inquiries which I was induced to make concerning it: "With the greatest pleasure I shall give you all the information in my power of the circumstances which led me to believe that the larva I brought from India, and sent to the late M. Latreille, was that of Anthia 6-guttata. M. De Haan of Leyden made a similar inquiry last year, and I informed

The larvæ of *Zabrus gibbus* (*fig.* 2. 6.) already mentioned, are described and figured by Germar in the first volume of his magazine; they are long and flattened, being nearly of equal breadth throughout, except towards the tail, which is gradually narrowed: the body appears to be of a more fleshy consistence than in the majority of these larvæ, and the body is terminated by two small spines. The pupa does not present any material characters.

A Swedish naturalist, M. Acrel, in a Memoir inserted in the sixth volume of *Nova Acta*, of Upsal, relating to larvæ and other objects sometimes found in the human stomach, has described and figured a larva which he considers to be that of *Sphodrus leucopthalmus*, and which had been ejected from the stomach of one of his patients. Such, of course, is not the real habits of this insect, since Latreille considers that the larvæ figured by Gœdart, (*fig.* 107. *a*, *b*,) are referrable either to this species or to Abax striola. Certainly, Gœdart's insects, in their general appearance, strong jaws, and predacious habits, coincide with the typical larvæ of this family, one of them being described as preying voraciously upon softer larvæ; and the other, which remained in the larva state two years, and of which he has given the transformations, feeding, not only on other larvæ, but also on the pupæ of ants, the eggs of mole crickets, &c.

I am not certain to which species of the family the larva which I have represented in *fig.* 2. 4. is referable; it agrees, however, with

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him that being on a visit in Burdwan in Bengal, one night returning home I observed by the light in a lantern the larvæ crawling in the road. I immediately took it to be the larva of some large Coleopterous insect, but had not the least idea to which it belonged till the day after, when I observed at the foot of a large Banian tree several Anthia guttata, which I could not, however, secure, as they retreated into holes when I came near them. I therefore ordered my palankin-bearers to dig them out, when we at the same time obtained another of the larvæ found on the preceding evening; without being positive, as I wrote to M. Latreille, I now naturally considered it to be that of an Anthia and concluded it was in the habit, during the night, of leaving its hole and crawling about in search of worms. M. De Haan having observed to me that this larva, whereof he had seen a figure in the French works, appeared according to his observations to belong to an *Elater*, I informed him that on the very tree where we obtained the larvæ from the holes at the roots, I found *Elater fuscipes* Fabr., in great abundance; this being the largest Elater which ever came under my observation in Bengal. I think this larva is much too large for such an insect, nor should I think a larva of an Elater would crawl so well on the ground. In other parts of India very large Elaters are found; in Java I once took a pair as large as E. flabellicornis." Copenhagen, July 5. 1836.

the typical larvæ of the family. And as I have found numerous specimens of it, as well as others, but slightly differing from it in essential characters, I have little doubt that it belongs to one of the large common black Harpalides (perhaps *Steropus madidus*, or *Omaseus melanarius*), and do not hesitate to give it as an example of the group. It is black and scaly, the head (*fig.* 2. 5. under side) is armed with two acute mandibles, two moderately long 4-jointed antennæ, two long 4-jointed maxillary palpi, and two short thick labial palpi; there are six small simple eyes on each side behind the antennæ, set in a circle. The under side of the head is scaly, the parts of the mouth being inserted near the front; the legs are moderately long, and the terminal segment of the body is armed with a pair of horny bifid spines.

The larva represented in *fig.* 2. 7. was described and figured by Desmarets (*Bulletin Soc. Philomat.* vol. i.), whose reasons for regarding it as that of Omophron limbatum appear to be satisfactory: it is of an intermediate form between that of the larvæ of the *Carabidæ* and *Dyticidæ*, being oblong, depressed, narrowed behind, with the head very large, and broader than the rest of the body, and armed with two very robust jaws, and other usual parts of the mouth, two 5-jointed antennæ, and two small eyes placed at the sides of the head; the tail is formed of a slender 4-jointed appendage, with two hairs at its extremity; the legs are moderately long. It was generally found in moist sandy places on the banks of the Seine, where the perfect insect was also met with in company with it, the food of both consisting of small sub-aquatic insects. The larva is very active, and, when touched, throws up its tail in the manner of a Staphylinus. The anatomical observations of M. Dufour seem to confirm the intermediate location of this genus between the Carabidæ and Dyticidæ; the perfect insect, although unable to swim, cannot live except in damp situations, and, indeed, Clairville placed it at the head of the Water-beetles.

M. Zimmerman, in his Monograph upon Amara, has given some account of the early stages of the insects of this genus. Considering some species as annual, and others as producing two broods in a year, and that the period of their appearance is not, like that of Moths, &c. fixed to a particular time, he adds, that the duration of life of these insects, from their bursting from the eggs to their death, never exceeds a year, whilst, in some species, it is certainly shorter. Those which

appear at the end of the summer in the perfect state, generally couple in the autumn, whilst in others this does not take place until the following spring. The eggs do not arrive at maturity until several days after coupling; they are deposited under stones, or at a small depth under ground. The larvæ soon appear; they change their skin once, and attain, previous to becoming pupæ, twice the length of the imago: the larvæ have the same general form of those of the Zabri and Pœcilli, and are so much alike that it is not possible to distinguish the species. They remain about six or eight weeks as larvæ, and half that time as pupæ; the perfect insects are able to live a much longer time, especially if coupling is delayed, immediately after which they die.

Latreille is the first author who directed the attention of entomologists to the distribution of the numerous groups composing this family. So far indeed from abandoning the hope of effecting a natural arrangement (as asserted by Mr. MacLeay), he has proposed a classification of them "fondée sur des rapports naturels" in the *Coléoptères d'Europe* which appears to me to be the most natural of any given, and which I propose to adopt in the following pages. He considers that the first group having truncated elytra, and noted for their explosive powers (Brachinidæ *MacLeay*, Truncatipennes, *Latr.*) is connected on the one side with the Cicindelidæ by means of Anthia and some other genera; and on the other, to the second group distinguished for its fossorial habits, having the elytra separated from the thorax by a wide incision (Scaritidæ *MacL.*, Bipartiti *Latr.*) by means of Enceladus and Siagona. From this second group he proceeds by Aristus and Acinopus to Zabrus, Cephalotes, &c. in the third group composed of the Harpaliens and Feroniens (Harpalidæ *MacL.*, Thoracici *Latr.*) distinguished by their great quickness in running; whence by means of Licinus, Panagæus, &c. we approach the fourth group, having the inner surface of the anterior tibiæ not notched, and which emit an extremely acrid fluid (Carabidæ *MacL.* Abdominales, *Latr.*), from which by Nebria, Elaphrus, &c., we arrive at the fifth group, composed of the genus Bembidium, having the last joint of the maxillary palpi minute and acute (Bembidiidæ *Stephens*, Subulipalpes *Latr.*), which approach the Water-beetles in their subaquatic habit: the genus Haliplus, amongst the latter, closely resembling Bembidium in the curious structure of the palpi.

Other instances in support of Latreille's arrangement may be given;

thus Ozæna hitherto regarded as one of the Bipartiti of Latreille, is now, from its explosive powers, proved to belong to the Bombardiers; whilst on the other side Mr. Curtis has suggested that a connection between the Scaritides and Harpalides may be effected by means of the genera Miscodera (Leiochiton *Curt.*) and Clivina; but a more beautiful connecting link between these two subfamilies exists in a yet undescribed insect from New Holland in the collection of the Rev. F. W. Hope, which strongly partakes of the characters of both groups; whilst between the Harpalides and Carabides the genus Eurysoma (Brachygnathus *Perty*) having the appearance of Cychrus, may be mentioned, as well as the genus Tefflus, regarded by M. Brullé as more nearly allied to Panagæus than to Carabus.

Latreille, indeed, was subsequently induced to adopt an arrangement of these groups proposed by Dejean by commencing with the Abdominales or Carabides, and in so doing has pointed out other apparent transitions; but in their more recent works, both authors have abandoned the latter arrangement and adopted that given above, with the exception that Dejean has raised these five groups, as well as two others, separated from the Harpalidæ, to an equal rank with the Cicindelidæ. Mr. MacLeay, also, in his *Annulosa Javanica*, has elevated the sections of the Linnæan genus Carabus to an equal rank with the last-mentioned family; but from pursuing a quinarian arrangement of the Geodephaga, he has been enabled only to admit four divisions of the Carabidæ. The group of Bembidiidæ is therefore sunk, the structure of the palpi being considered insufficient for its support: if this character were indeed the only distinctive mark of the group, this step might still be questioned, as no other Carabidæ possess such a structure; but the group is also characterised by the minute size, great agility and subaquatic habits of the insects of which it is composed; moreover, in point of number of species, it is not an inferior group. If even it were to be suppressed, its situation would evidently be nearer to Elaphrus than to Harpalus, which would, of course, interfere with Mr. MacLeay's distribution, which (notwithstanding his remark upon the Latreillian distribution) is, with the exception of the suppression of the Bembidiidæ, identical with that given above; the progression being merely reversed, by which means a passage is effected between the Cicindelidæ and Elaphrus amongst the Carabidæ*, which two families he considers as forming a normal

* Mr. Curtis has adopted this view in his observations on Pelophila, although in those upon Elaphrus, he regrets that Dejean should have removed that genus and

group, having entire tibiæ, whilst, in his three other families, which he terms aberrant, they are deeply notched.

Messrs. Kirby and Spence divide the Carabidæ into two subtribes, Lampr*ona*, named from the brilliancy of colour of many of the species and corresponding with Latreille's Abdominales, and Amaur*ona* or those of obscure colours, and comprising all the other groups of Latreille, the latter subtribe being divided into stirpes, as Truncipenn*una*, &c.; these stirpes, however, being evidently of equal value with the entire subtribe Lamprona, this primary mode of division cannot be considered satisfactory.

Mr. Stephens has proposed six families of Carabideous insects:— 1. Brachinidæ *MacL.* 2. Scaritidæ *MacL.* 3. Carabidæ *MacL.* 4. Harpalidæ *MacL.* 5. Bembidiidæ *Steph.*, and 6. Elaphridæ *Steph.* This distribution is, however, evidently unnatural, separating, as it does, the Harpalidæ and Scaritidæ, and the Carabidæ and Elaphridæ. No affinity, moreover, is traced between the Scaritidæ and Carabidæ.

Other modes of distribution have been proposed by Zimmerman (*Monog. Amaroidum*), Laporte (*Etudes Entomol.* livr. i.) and Brullé (*Hist. Nat. Ins. Col.* vol. i.), which it would be tedious to detail. In all these arrangements, however, the Harpalides are divided into three groups, corresponding with the Simplicimana, Patellimana, and Quadrimana of Latreille (*Règne Animal*, 2d ed.). The latest arrangement of these insects is that of Mr. Kirby, given in the *Fauna Boreali-Americana*, and which is as follows:—

- Geodephaga.
  - Euptera. (Cicindelidæ.)
  - Eutrecha.
    - Truncipennia. (Brachinidæ *M'L.*)
    - Obtusipennia.
      - Nobilia (Carabus, &c.).
      - Plebeia (Nebria, &c.).
    - Sarrothropoda. (Chlænius.)
    - Cystopoda.
      - Dimana (Agonum, Calathus, and Feronia, &c.).
      - Quadrimana (Harpalus).
- Hygradephaga.
  - Acutipalpia
    - Quadrimana. (Stenolophus.)
    - Dimana. (Trechus, Patrobus, &c.).
  - Subulipalpia. (Peryphus, Bembidium, &c.)
  - Filipalpia. (Elaphrus.)

Omophron (both belonging to the same group) from the termination of the Carabidæ, considering the latter genus as "ordained by nature perfectly to connect the Carabidæ with the Dyticidæ."

Mr. Kirby as well as Messrs. Laporte and Brullé have also adopted the plan of subdividing the primary groups into numerous minor subdivisions named after the typical genus in each: thus by both the last named authors, the Brachinidæ are divided into six minor groups, not however corresponding with each other, as the sixth subdivision (Brachinites) of Laporte embraces Brullé's 1st, 5th, and 6th, subdivisions.

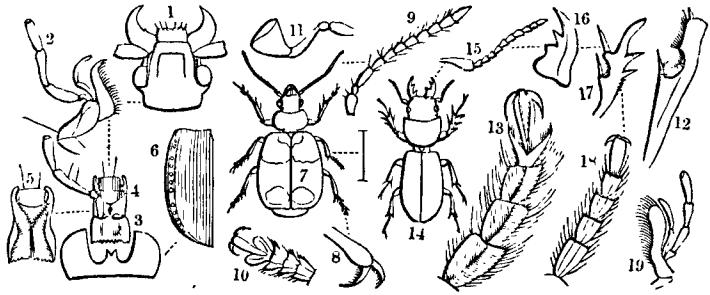
In considering the different primary divisions of this very natural family, as possessing a value inferior to that of distinct families, and as constituting collectively one family of equal rank with the Cicindelidæ, I am but treading in the steps of Linnæus, Latreille, Kirby, and Leach, as well as in those, I cannot but think, of nature herself, notwithstanding the numerical majority of the Carabideous over the Cicindelideous insects. The following is a concise tabular sketch of these different groups which I have considered as sub-families, terminating them, for uniformity, in *ides*.

A. External maxillary palpi terminated by a joint at least as large as the preceding (*fig.* 3. 2.).
  a. Anterior tibiæ having a deep notch on the inside, near the tips (*fig.* 3. 12.).
    * Elytra generally truncated behind (*fig.* 3. 7.). Tarsi of the ♂ seldom dilated at the base. — 1. *Brachinides.* (Bombardiers.)
    ** Elytra rounded at the extremity; abdomen pedunculated (*fig.* 3. 14.). — 2. *Scaritides.* (Burrowers.)
    *** Elytra rounded behind; abdomen not pedunculated (*fig.* 4. 1.). — 3. *Harpalides.* (Black clocks.)
  b. Anterior tibiæ not notched near the tip (*fig.* 4. 12.) — 4. *Carabides.* (Dischargers.)
B. Palpi terminated by a minute conical joint (*fig.* 4. 18.). — 5. *Bembidiides.* (Subaquatics.)

The first sub-family BRACHINIDES, in addition to the truncature of the extremity of the elytra, are characterised by having the head and thorax narrower than the abdomen (*fig.* 3. 7. Lebia Crux minor, 8 ungues, 9 antennæ). The labium is often oval or square, and occasionally furnished with two small lateral linear lobes: in many of the smaller species the penultimate joint of the tarsi is bilobed (*fig.* 3. 10. anterior tarsus of Cordistes), and the anterior tarsi of the males are very rarely dilated at the base; in some of the large exotic genera, as well as in the true Brachini, the body is apterous, whilst others are very narrow and subcylindric, and have been supposed to be allied to the cylindric Cicindelidæ.* Their colours are more

* M. Brullé places his division Trigonodactyliens at the head of the Carabidæ, M. Audouin having observed that the maxillæ in the typical genus have the terminal unguis articulated, as in the Cicindelidæ.

Fig. 3.



pleasantly variegated than in the majority of the family. Other peculiarities have already been pointed out.

This sub-family, as at present constituted, is perhaps the most incongruous of all the sub-families of the Carabidæ, the term Truncatipennes applied to it by Latreille by no means indicating a constant character, as many of the species have the elytra rounded at the tips. The tarsi indeed are generally alike in both sexes, or if dilated in the males, the dilatation is of a different character from that of the other sub-families. In may, indeed, be rather regarded as a convenient receptacle for such groups as have not the bipartite and palmated structure of the Scaritides, the simple tibiæ of the Carabides, the dilated male tarsi of the Harpalides and its subdivisions, or the minute conical terminal joint of the maxillary palpi of the Bembidiides. The tarsal claws are often denticulated (*fig.* 3. 8. claws of Lebia); but this structure is found elsewhere in the family.

The typical species of this sub-family are endowed with a means of defence of the most singular description, from whence they have derived the name of Bombardier-beetles, and which was first mentioned by Rolander in the *Transactions* of the Academy of Stockholm for 1750. When the insect is attacked by other and larger insects, or placed in a situation of danger, it suddenly emits from the anus a fluid of so highly volatile a nature that, immediately upon coming into contact with the atmospheric air, it becomes a bluish vapour of a very pungent scent, accompanied with considerable explosion, whereby the insect is enabled to effect its escape. This it is enabled to repeat seven, eight, or even a dozen times. It is stated by an anonymous author (*Ent. Mag.* iii. 377.), that on immersing a specimen of Br. Græcus in boiling water, it let off one of its explosions, and the water

for about an inch around it effervesced much in the same way as a Seidlitz powder. The typical species Brachinus crepitans *Linn.*, is not uncommon, being found in company under stones; and it is stated that these communities have been found at times to consist of at least a thousand individuals. The effect of this vapour upon the skin is very similar to that produced by nitric acid. M. Dufour has published a description of the organs by which this fluid is secreted in the Brachinus balista, which will be found in the eighteenth volume of the *Annales du Muséum*, as well as in the sixth volume of the *Annales des Sciences Naturelles.** Kuhn has also published an account of the habits of these insects in the thirteenth volume of *Der Naturforscher.* Some authors have thrown doubts upon the statement that the explosion of these insects is accompanied by a noise; the following circumstance, however, communicated to me by the celebrated traveller Burchell, will be sufficient (were other evidence wanting, which is not the case) to confirm the correctness of the recorded statements. Whilst resting for the night on the banks of one of the large South American rivers, he went out with a lantern to make an astronomical observation, accompanied by one of his black servant boys; and as they were proceeding, their attention was directed to numerous beetles running about upon the shore, which, when captured, proved to be specimens of a large species of Brachinus: on being seized they immediately began to play off their artillery, burning and staining the flesh to such a degree, that only a few specimens could be captured with the naked hand, leaving a mark which remained for a considerable time; upon observing the whitish vapour by which the explosions were accompanied, the negro exclaimed in his broken English, with evident surprise, "Ah! massa, they make smoke."[1] The late traveller, Ritchie, communicated to Mr. MacLeay some particulars respecting this secretion; his companion, M. Dupont, having taken a nest consisting of more than a thousand individuals near Tripoli. He says the crepitating matter made Dupont's fingers entirely black when he took them: it is neither alkaline nor acid, and it is soluble in water and in alcohol (*Kirby and Spence, Int.* iv. p. 143.). From a communication made by Mr. Holme to the Entomological Society (*Trans.* vol. ii. p. 7.), it would appear that the crepitation may be produced for a considerable time after the

* Also in the "Recherches Anatomiques," p. 204.

death of the insect by pressing the abdomen near the anus, probably until the secreting organs are become rigid. Mr. R. H. Lewis also states that the New Holland species of Lebia emit a very pungent odour, resembling muriatic acid, which, applied to the nostrils, produces considerable irritation. *Trans. Ent. Soc. Lond.* vol. i. p. 81.

The British genera are Drypta, Polystichus, Odacantha, Demetrias, Dromius, Lebia, Lamprias, Tarus, and Brachinus.

The only British species contained in the genus *Polystichus* is a curious insect about one third of an inch long. It has lately been captured in considerable numbers on the coast of Suffolk, and has been regarded by all English authors as the Polystichus fasciolatus of Rossi, from which, however, it is distinct. M. Brullé, who has corrected the synonymy of this and the allied species, has given to the English species the name of *P. vittatus*. The only English species of the genus Odacantha is one quarter of an inch long, of a bright testaceous colour, with the head and thorax blue. It is found in Norfolk, and some of the other eastern counties, and has lately been taken in profusion by the Cambridge entomologists in the reedy fens in that neighbourhood. It is also found in the sedge boats upon the river Cam, having escaped from the bundles of sedge, which is brought in great quantities to Cambridge. M. Brullé mentions, that many hundred specimens of this insect were taken under the bark of trees growing in water in Italy, although they have never since occurred in the same locality, and, indeed, are very rare in the neighbourhood. The species of the genus *Dromius* are amongst the smallest Carabideous insects, and are generally found under the bark of trees, especially during the winter. A memoir upon this genus has been published, in the Transactions of the Entomological Society, by C. C. Babington, Esq., in which the difficult synonymy of many of the species has been cleared up.

The genera *Lebia* and *Lamprias* are regarded as congenerous by the French entomologists, notwithstanding their evident distinction. The species of both are very elegantly diversified with different colours, and are generally rare. Like the Dromii, they are often found under the bark of trees. Some of the species of *Tarus* have the palpi considerably dilated in the males (*fig.* 3. 11.), which induced Fischer to form them into a distinct genus, named Anomæus. They are chiefly inhabitants of Europe.

The genus Brachinus (*fig.* 3. 12. anterior tibia) contains about forty

species, which are very widely distributed. Their explosive properties have been already described, to which may be added, that both sexes possess this power. M. Solier has published a memoir upon this and the allied genera in the *Annals of the Entomological Society of France*, vol. ii., to which M. Brullé has published a reply in the fourth volume of the same work.

In addition to the genera enumerated above, Mr. MacLeay has suggested that the genus Plochionus *Dej.* may be expected to occur in the south of England or Ireland, particularly Plochionus Bonsfilsii *Dej.* (*Annul. Javan.* No. 1.); but, from the observations of M. Barthelemy, it is evident that the insect last named is imported into France from the island of Martinique, with Cassia bark. (*Ann. Soc. Ent. France*, vol. iii. 429.)

The following are amongst the most remarkable exotic genera belonging to this subfamily: —

Anthia, Weber, comprising some of the most gigantic species in the whole family; in some of which the males have the mandibles of an immense size, and the thorax, as it were, divided into two parts. M. Lequien has published a monograph upon this group in Guerin's *Magasin de Zoologie*. The large East Indian species, Anthia sexguttata is found, according to Mr. Westermann, at the roots of the Banian tree. The majority of the species are from Southern Africa; there are some observations on the habits of these insects in Burchell's Travels in the Interior of Southern Africa, 1824, by whom one of the species is named A. effugiens.

This genus, with Helluo and its allies, exhibits a peculiarity in the clothing of the under side of the anterior tarsi. (*fig.* 3. 13. Helluo.)

The species composing the allied genus Graphipterus have somewhat the appearance of broad Cicindelæ. They have been generally considered to be nocturnal in their habits; but M. Lefebvre, whilst in Egypt, observed the habits of one of the species, which was discovered by him running about in the hottest part of the day, at the commencement of March near the confines of the desert. He likewise observed that it produces a very distinct noise, by rubbing the posterior femora against the margins of the broad elytra. (*Ann. Soc. Ent. France*, No. 3.)

The beautiful South American genus *Agra* is distinguished by its long narrow body; the thorax being conical; the maxillary palpi filiform, and the labial terminated by a securiform joint. According

to M. Lacordaire, the species, which are numerous, are found upon trees, preferring those leaves which have been rolled up by other insects, upon which they sit, remaining immoveable, with the fore legs and antennæ stretched forwards. When approached, they escape quickly, falling amongst the grass. Their long neck and head are said to hinder them from walking quickly, these parts being constantly brought into contact with the leaves upon which they are in motion. Dr. Klug has published a beautifully illustrated monograph upon this rare genus in his *Entomological Monographs.*

The elegant exotic genus *Casnonia* Latr. (Ophionea *Klug*, or rather, Colliuris *De Geer*, but not of *Latr.*) is distinguished by the very long cylindrical neck-like thorax, wide head, prominent eyes, and broad elytra. The species are of small size; the type is the Attelabus pensylvanicus *Linn.* M. Lacordaire has observed that they reside in marshy places, running very quickly on the margins of streams, and taking flight readily, when they are easily mistaken for small Cicindelæ.

The genus *Mormolyce* Hagenb. comprises the largest known Carabideous insect, the form of which is quite flat, and so extraordinary that it would scarcely be recognised as a Coleopterous insect. The head is attenuated behind the eyes into a very long narrow neck; the thorax has the lateral margins strongly denticulated; and the elytra are dilated at the sides and extremity into a very broad leaf-like appendage, giving the insect the aspect of a Mantis. The notched tibiæ, and structure of the mouth and posterior trochanters appear to give it the affinity with Sphodrus, as suggested by Latreille, of which genus it is even regarded by M. Brullé merely as a subgenus. Its situation has, however, greatly perplexed systematists. By Klug and St. Fargeau (*Enc. Meth.*) it is arranged with the Brachinides; the former placing it between Drypta and Agra, with which last it has some general resemblance in form, with the exception of the dilatation of the elytra; whilst Mr. Curtis considers it natural to place it as the head of the Coleoptera and Eumorphus at the end, thereby to complete the Coleopterous circle. I would suggest that, as its general appearance indicates a certain weakness of structure, very unlike that of the Harpalides, and as, out of the many individuals which I have examined, I have never been able to find an individual with dilated anterior tarsi, it would be more natural to consider it as allied to the

Lebiæ and some other of the Brachinides*, which are found under the bark of trees, it being in such situations in Java that the Mormolyce is said to be found. It is subject to considerable variation in size: the largest specimen which I have seen measures three inches and a half in length, and is in my collection. M. Laporte de Castelnau has suggested that the extraordinary larva described by Perty, and subsequently noticed under the family Lampyridæ, may be that of Mormolyce (*Hist. Nat. Anim. Art.* p. 119.). I cannot, however, adopt such an opinion.

The genus *Ozæna* Oliv. has been placed by Latreille and Dejean amongst the Scaritides; its characters are, however, very unlike those of that sub-family; and M. Lacordaire has observed, that the Brazilian species possess similar explosive powers to those of the Brachini; hence Messrs. Brullé and Laporte have introduced this genus into the latter family. (*Ann. Scienc. Nat.* June, 1830. *Ann. Soc. Ent. France*, No. 4.) Most of the species have a curious tubercle near the base and apex of the margin of each elytron. I have published a memoir upon this and some new allied genera in Guérin's *Magasin de Zoologie*, 1834.

The extraordinary North American genus Pseudomorpha *Kirby* (*Linn. Trans.* vol. xiv. Heteromorpha *Kirby*, ibid., pl. 3. f. 3. Axinophorus *Dej.*) may also be here mentioned. Although exhibiting the characters it has not the aspect of a Carabideous insect, and might be mistaken for a large Nitidula. It appears to have been previously described by Illiger under the name of Drepanus. Its situation is very dubious; Mr. Kirby thinking it nearer to Omophron than to the Brachinides, with which in several respects it agrees, and in which it is arranged by Dejean, whilst Latreille in his last works has placed it amongst the Feroniens. The head and thorax are very broad, and the legs and antennæ short. But a still more extraordinary genus is Adelotopus *Hope* (*Trans. Ent. Soc.* pt. 1.), in which the body has all the appearance of an elongated Gyrinus, and the antennæ are clavate. In some other respects, it is nearly allied to Pseudomorpha. I have communicated a memoir upon these and some other equally singular allied Australian insects to the Linnæan Society.

* This opinion has been confirmed by the recently published observations of Count Mannerheim, who has described the sexual distinctions of this insect. (*Bull, Soc. Imp. Mosc.* 1837, p. 26.)

The second sub-family SCARITIDES (Bipartiti *Latr.*) is distinguished by having the elytra separated from the lunate thorax by a considerable space, which causes them to appear pedunculated (*fig.* 3. 14. Scarites lævigatus), and they are rounded at the extremity; the antennæ are short, and often elbowed (*fig.* 3. 15.), the first joint being long; the head is large; the tarsi (*fig.* 3. 18. under side of tarsi of Scarites) are generally alike in both sexes; and the tibiæ of the fore-legs are broad, and very much dentated (*fig.* 3. 17.) or palmated, wherewith the insects are enabled to burrow in the earth or sand; the mandibles (*fig.* 3. 16.) are generally very powerful, and internally armed with broad teeth.

These insects are for the most part found under stones, and in holes in the ground near water, or upon the sea-shore. They appear to be chiefly nocturnal in their habits, and hence their colours are for the most part black or obscure. The larger species are chiefly inhabitants of the New World. Their numbers are much more limited than those of the Brachinides or Harpalides. Latreille and Dejean consider these insects as not carnivorous, but Olivier and De Cerisy have stated, that they are insects of prey, and that S. gigas lurks by day in holes and under stones, and sallies forth at night to feed upon Melolonthidæ and other insects which may fall in its way. (See *Ann. Jav.* pt. 1.) M. Lacordaire states that the species of Scarites burrow in the sand of the sea-coast in South America, but are more generally found under the stumps of felled trees; whilst one of the species, Sc. anthracinus *Dej.*, is necrophagous, being found in half-decayed carcasses. Scarites lævigatus, according to an anonymous author (*Ent. Mag.* vol. iii. p. 177.), feeds upon live sand shrimps (Gammari ?) upon the shores of the Mediterranean, which it drags out of their perpendicular burrows.

The genus *Scarites* comprises some of the largest species in the family: that found in this country is very rare; the body is oblong, subdepressed, the antennæ strongly elbowed, and the jaws armed with strong teeth. I have already noticed the habits of Scarites gigas. M. Brullé* has observed, upon the sea-coast in Greece, a quantity of the Scarites lævigatus running about in the hot sunshine, and entering into circular burrows in the sand, from which they passed and repassed without apparent reason: "car il ne transpor-

* Hist. Nat. Insectes, col. 2. p. 35.

tait point de proie." He conjectures that they were occupied in searching for their mates. I should however rather consider that, as in the case of the Scarites lævigatus already, and a species of Dyschirius subsequently, mentioned, they were searching after other insects (which formed these burrows) for their prey. M. Lefebvre has described, in *Guérin's Magasin d'Entomologie*, a remarkable monstrosity occurring in a specimen of Scarites pyracmon, in which three distinct tibiæ and tarsi arise from the extremity of one of the anterior femora.

The *Oxygnathus anglicanus* Hope is a remarkable insect, of which a single dead specimen was picked up near Peckam, Surrey. It is half an inch long, and is evidently an insect imported from the tropics. Brullé considers it identical with the Camptodontus Cayennensis *Dej.*

The character pointed out by Mr. Curtis, for the discrimination of the species of *Clivina*, is not constant; the C. fossor sometimes occurring with ample wings. See the observations of Mr. Stephens upon this subject (*Illust. Mand.* i. 177.). The insects considered as distinct species by English entomologists are regarded as varieties of C. fossor by some Continental authors.

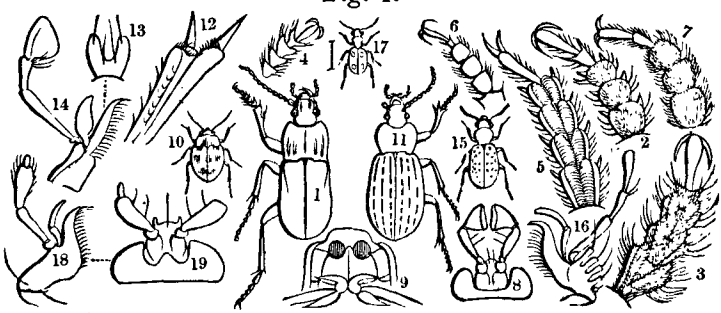
The species composing the genus *Dyschirius*, Bonelli, are the smallest of this sub-family, never exceeding one-sixth of an inch in length, and, like the Dromii, their numbers in temperate climes far exceed those of the larger genera. Their colours are generally black, tinged with brassy green. There appear to be twelve or fourteen British species, of which the D. gibbus is very common in damp situations. According to Ahrens, however (who has published a monograph upon this genus in *Thon's Entomological Archives*, vol. ii.), the insect described by Gyllenhal, Dejean, &c. as the gibba, is distinct from the true gibba of Fabricius; the former insect, which is our common British species, is described by him under the name of C. minima, whilst Mr. Curtis has also described another British species under the latter name, which must consequently be changed. The Rev. G. T. Rudd has published some observations upon the habits of one of the species of this genus, noticed by him upon the Yorkshire coast: "On turning up the sandy tracks or burrows above high-water mark, to uncover the Hesperophili (species of Brachelytra), I found their ferocious enemy, the aforesaid Dyschirius, pursuing his work of destruction. These Dyschirii burrow after, seize, shake, as the Cicindela campestris does its prey, and devour the luckless Hesperophili: so intent are they on their purpose, that I have frequently observed them to

shake their victim after they were both brought to light." (*Entom. Mag.* vol. ii. p. 181.)

Amongst the exotic Scaritideous genera may be mentioned Oxystomus, remarkable for its narrow elongated form and the very large size of its falcate mandibles, from South America; Ditomus, of which the males have the head generally armed with a strong occipital horn, chiefly from the shores of the Mediterranean (see *Brullé, Expedition Scientifique de Morée*); Enceladus, comprising a single species of large size, from Angola, having the anterior tibiæ quite simple; Siagona, having the body quite flat; Carterus, having the anterior tarsi of the males dilated; and Apotomus, having the maxillary palpi of very great length, and composed of a few minute European species, with long slender legs and the thorax narrow. The genus Carenum is confined to New Holland; the Eutoma tinctilatus *Newm.* being merely a linear species of that genus. This genus exhibits a remarkable character, which has not hitherto been noticed, and which exists in no other Carabideous insects, namely, the maxillæ are destitute of a terminal hook (*fig.* 3. 19.).

The third subfamily HARPALIDES (Thoracici *Latr.*) is far more extensive than any of the other subfamilies, and is distinguished by having the elytra sessile and not pedunculated, entirely covering the abdomen, and rounded at the extremity (*fig.* 4. 1., Abax striola).

Fig. 4.



The palpi are not terminated by a minute conical joint (*fig.* 3. 2. 4.); the anterior tibiæ have a deep notch near the tip, but are not palmated; the basal joints of the two or four anterior legs are dilated in the males (*fig.* 4. 2. anterior male tarsus of Broscus cephalotes; 4. 3. ditto, Abax striola; 4. 4, 5, ditto, Harpalus rufipes, above and beneath; 4. 6, 7, ditto, Chlænius, above and beneath); the body more or less elongated,

and the neck scarcely ever distinct. The mentum is produced on each side into a rounded lobe, the centre portion being deeply emarginate, occasionally entire (*fig.* 4. 8. Licinus), but generally with a short spine in the centre of the emargination, which is sometimes notched at the tip (*fig.* 3. 3.).

This subfamily comprises a vast number of species, divided into numerous genera by Bonelli and the more recent entomologists, forming small natural groups, which are, nevertheless, very difficult to characterise, their structure gradually passing into the adjacent forms, so that it is almost impossible to fix their limits with any degree of precision; which difficulty is still further increased by the obscure tints and slightly varying characters of the species.

Latreille and Dejean have divided this subfamily into three groups, which, from the structure of the anterior tarsi of the males (upon which they are chiefly founded), they term Quadrimani, Simplicimani, or-pedes, and Patellimani. Mr. Stephens, however, considering the impossibility of distinguishing genera from such a mode of distribution, when the females alone are known, has given a table (*Illustr. Brit. Ent. Mand.* vol. i. p. 67.) founded upon characters common to the sexes; the mentum, however, upon the variation in which he has founded his chief divisions, is liable, as he himself admits, to considerable variation. Moreover, the general results of this table are similar to those of Latreille's mode of division; whence I propose to adopt the latter, especially as, in his later works, Latreille has added other characters to distinguish his three groups.

Messrs. Audouin and Brullé have noticed (without acknowledging the observation as that of L. Dufour, *Rech. Anat. Col.* pl. 21*. f. 3–5.) a peculiarity in the construction of the tarsi of the Patellimani (Chlæniens), the males of which have the cushion-like clothing of hairs on the under surface of the foot generally distributed over the sole of the tarsus (*fig.* 4. 6, 7.) In the Quadrimani (Harpaliens) the dilated joints of the anterior male tarsi are furnished beneath with a double series of narrow cushions, which, in H. rufipes, appear to be fleshy and transversely striated, and to be destitute of pilosity (*fig.* 4. 4, 5.). This character, although it may be sufficient to separate the Chlæniens from the Harpaliens, as suggested by Messrs. Audouin and Brullé, does not, however, appear to be a fixed character, being liable to much variation in the Feroniens; thus, in Abax striola, each joint is provided with a double hairy cushion, extending beyond the extremity of the joint (*fig.* 4. 3.); but in Broscus

cephalotes the cushion of each joint is entire and nearly circular (*fig.* 4. 2.); and Burmeister figures a tarsal joint of Zabrus, with cushions transversely striated, as in Harpalus.

Comparatively few of the species are ornamented with metallic colours, the majority being of black or obscure tints, whence they have obtained in some parts of the country the name of Imps. Mr. Stephens mentions that they are greatly infested with Gordii. The metallic species of Amara and Poecilus are termed Sun-beetles, from their habit of running about footpaths during hot sunshiny weather. The obscure coloured species, on the contrary, are barely seen by day, chiefly coming abroad in the twilight, thus affording an instance of that distribution of colours which I have often observed in other groups; from which it is evident that, although Nature is lavish in her brilliant hues, they are only bestowed upon those which, from the nature of their habits, are exposed to the glare of light and to the view.

The subfamily HARPALIDES is closely allied on the one hand to the Scaritides as above mentioned, whilst some of the genera (Licinus, Badister, Panagæus) approach the aberrant Carabides; others again, as the Trechi, are intimately allied to the Bembidiides.

1. The first division (Feronidea *Westw.*, Feroniens *Dej.*, Simplicimani *Latr.*) has the two anterior tarsi of the male alone dilated, the basal joints not being oblong nor orbicular, the four posterior tarsi simple. The central tooth of the mentum is generally notched at the tip.

The characters of many of the genera of this section are so undecided, that Dejean has expressed his inability to separate them precisely, and has accordingly united them into one great genus, Feronia, which he has subdivided into various sections; still, however, to a practised eye, their appearance is so distinct that, with a little tact, they may be at once recognised.

2. The second division (Harpalidea *Westw.*, Harpaliens *Dejean*, Quadrimani *Latr.*) has the four anterior tarsi dilated in the males (*fig.* 4. 4., anterior male tarsus, Harpalus). The mentum-tooth is generally acute, but never notched: in some genera, however, it is almost imperceptible; the claws of the tarsi are simple, and never toothed. I have added the genus Trechus into the synoptic list of the British genera, from its decided affinity with Stenolophus.

3. The third division (Chlæniidea *Westw.*, Chlæniens *Dej.*, Patellimani *Latr.*) has the anterior tarsi of the males with two, three, or four of the basal joints square or cordate, with the anterior angles rounded, and

not acute (*fig.* 4. 6. anterior tarsus of Chlænius). The legs are generally long, and the thorax often narrower than the abdomen.

Amongst the British genera the following are most worthy of notice: —

Division 1. The species of the genus *Pogonus* are of small size, not exceeding one-third of an inch in length. They are found in the salt marshes bordering upon the coast, which are, during the winter, entirely covered with water. Mr. Curtis has published some interesting observations upon these insects in his *Brit. Ent.* p. 47., communicated by Mr. Burrell.

The Rev. F. W. Hope has informed me that he has noticed the subpellucid margins of the thorax and abdomen of *Calathus* rufangulus to be slightly phosphorescent, which he conceives must have arisen from the insect feeding upon dead carrion lying on the shores of the Thames, whence the luminosity may be caused by the decomposition of the putrid matter which the animal had eaten. Perhaps, however, it is more probable that the luminosity arose from some of the matter in the midst of which the animal had been feeding still adhering to the surface of the body. Mr. Curtis has given a beautiful figure of a remarkable species of this genus, under the name of C. latus *Dej.*; but the C. latus *Linn.* is regarded by M. Brullé as synonymous with the C. cisteloides, whilst the C. latus *Dej.* is the C. punctipennis *Germar.*

In the genus *Sphodrus* the males have the trochanters of the hind legs produced into a long spine (*fig.* 4. 9.). The typical species is one of the largest Harpalideous insects, and is found in dark cellars and outhouses.

The species of the genus *Agonum* are very numerous; they frequent damp situations; some, as the A. marginatum, 6-punctatum, and fulgens, are of brilliant metallic colours, but the majority are black or obscure. They do not exceed one-third of an inch in length.

The genera *Broschus* and *Miscodera*, in their pedunculated abdomens, considerably resemble the Scaritides. The type of the former genus is found upon the coast; that of the latter has the appearance of a large Dyschirius, but the anterior legs are not palmated; the structure of the antennæ, trophi, and tarsi (having three dilated joints in the males) is also indicative of its situation amongst the Harpalides, as suggested by Latreille, in the *Régne Animal.* This insect has

lately been taken somewhat plentifully by the entomologists of the North of England, by one of whom, W. Hewitson, Esq., I am informed that the Leoichiton Readii of Curtis is a variety only of M. arctica.

The investigation of the species of the genus *Amara* is attended with very great difficulty, and has been much neglected. Dejean describes sixty-three species; Stephens gives twenty-six as British. M. Zimmerman has recently published a valuable memoir upon the genus in Gistl's *Faunus* (Munich, 1832), in which the species are carefully analysed, and several new subgeneric groups proposed.

The genus *Zabrus* is nearly allied to Harpalus in the following section. I have already detailed its natural history in the introductory observations upon the family. M. Zimmerman has published a memoir upon this genus and its allies, in his *Monographia Amaroidum*. The anterior tibiæ are terminated by a pair of strong spurs.

Division 2. The genus *Harpalus* is of very great extent, and requires a much more minute revision than has hitherto been given to it.

The genus *Masoreus* is at once distinguished from all the British Harpalides by the posterior lobe of the thorax, a character which exists in Lebia and Æphnidius *MacLeay* (*Java*). In other respects it nearly approaches Stenolophus. Mr. Curtis thinks it not improbable that this genus may form the connecting link between Dromius, amongst the Brachinides, and the Scaritides. There, however, appears to me to be but little ground for such an opinion. I am indebted to Professor Henslow for a specimen of this rare insect. M. Zimmerman has published a monograph on this genus in the second number of Gistl's *Faunus*.

The genus *Aëpus* Leach is united with Blemus by the French entomologists, notwithstanding its manifest differences. The fourth joint of the anterior tarsi of the males is armed with a strong spine; a character not noticed in any other Carabideous insect. M. V. Audouin has published a very interesting memoir upon the habits of this insect (*Nouv. Ann. du Mus. d'Hist. Nat.* tom. iii., and *Ann. des Sc. Nat.*, 1835), which resides, in general, under pebbles, at a considerable distance below high-water mark, on the shores of the ocean, in situations which are only exposed during very low tides. In this memoir the author has endeavoured to account for the physical peculiarities enabling the insect to sustain life in such a situation. Dr. Johnstone, to whom I am indebted for the insect, has discovered it

in the same situations near Berwick-upon-Tweed. It has also been found on other parts of our coast.

Division 3. The species of Mr. Stephen's genus *Trimorphus* (both of which are found near London) are nearly allied to Badister, with which they are united by the French authors. They are also apparently allied to Stenolophus; indeed Mr. Curtis considers S. consputus *Steph.* to be a Trimorphus. Their relationship with Domius appears to be very slight. Mr. Stephens appears to have mistaken the yellow membranous unnotched clypeus for the labrum, which, upon dissection, I find to be very minute and deeply notched. The terminal joint of the maxillary palpi is but little longer than the preceding, and, as well as the labial palpi, is terminated by an inflated membrane, which gives them the appearance of being obliquely truncate.

The genera *Chlænius* and *Epomis* are of great extent, being found in all quarters of the globe. They are elegant insects, having the upper surface of a silky green colour, bordered with a narrow yellow margin.

Amongst the exotic genera of this subfamily the most remarkable are a genus for which I propose the name of Campylocnemis (Hyperion * *Laporte*), and having for its type the large Australian insect, Scarites Schrœteri Screib., *Linn. Trans.* vol. iii., and which is placed by Laporte between Stomis and Poecilus. Having recently dissected this insect, I agree with M. Laporte in the propriety of its removal from the Scaritides, but regard it as more nearly allied to Omaseus and Catadromus. M. Brullé has regarded it as a subgenus of Morio†, but in the smaller size of the mentum (which in Morio occupies the entire of the under side of the front of the head and covers the maxillæ) and the strongly toothed mandibles, it is quite unlike that genus.

The French genus Gynandromorphus *Dej.* (*Car. Etruscus Sch.* Sturm., D. F. tab. 93. c.) is remarkable for having the anterior tarsi in the females very much dilated, a character only observable in another Carabideous genus, Gynandropus, from North America.

The interesting genus Catascopus of Kirby, *Linn. Trans.* vol. xiv., somewhat at first sight resembles a large Bembidium or Elaphrus, but its real affinity is considered by Mr. Kirby to be towards the Harpalides. It is regarded by some French authors as belonging to the

* Mr. MacLeay has described another Carabideous genus in the Annulosa Javanica, under the name of Hyphærion.

† An aberrant genus of the Scaritides, but possessing the dilated anterior tarsi; so that it ought, probably, to be considered as belonging to the Harpalides.

Brachinides. The species are of brilliant colours, and are inhabitants of the tropics.

The fourth subfamily CARABIDES (Grandipalpi or Abdominales *Latr.*, Simplicipedes *Dej.*, Carabidæ *MacLeay, Stephens*) comprises the typical Carabideous insects (*fig.* 4. 11. Carabus nitens), being for the most part of a large size, and distinguished from all the other subfamilies by having the anterior tibiæ destitute of the strong notch near the extremity (*fig.* 4. 12. Carabus), although, in some of the terminal genera, an approach is made to the emarginate structure of the Harpalides by a slight oblique canal occupying the tip only of the tibia. The jaws are strong, with but very few teeth on the inner edge; the antennæ are long and setaceous, the second joint being the shortest; the terminal joint of the palpi is often very large and securiform (*fig.* 4. 14. maxilla of Cychrus); the eyes are large and prominent; the abdomen and elytra often comparatively very large, the latter being rounded at the tips, and in the typical genera soldered together, the wings in such cases being obsolete; the anterior tarsi are greatly dilated in the males.

The larger insects of this family, CARABIDEA *Westw.* (Carabidæ *Steph.*), are generally adorned with metallic and brilliant colours; they run fast, are very carnivorous in their habits, and when irritated eject an exceedingly acrid and volatile fluid from the abdomen. The genera Elaphrus (*fig.* 4. 15. Elaphrus uliginosus), Pelophila, Blethisa, and Notiophilus, are formed by Mr. Stephens into a distinct family, named Elaphridæ (ELAPHRIDEA *Westw.*); whilst the same genera, together with Nebria, Leistus (*fig.* 4. 16. maxilla of Leistus showing its curious spines), and others, are separated by Messrs. Audouin and Brullé under the name of Elaphrides.

Amongst the British insects belonging to this subfamily several species of the genus *Chychrus* appear to have been incorrectly recorded as British. The only indigenous species, C. rostratus, as I am informed by Mr. Plimpton, makes a very loud noise when captured by the friction of the tip of the abdomen against the elytra, a peculiarity not observed in any of the other species of the family. Its upper lip is represented at *fig.* 4. 13., and one of its maxillæ exhibiting the curious internal palpi at *fig.* 4. 14.

The genus *Carabus*, notwithstanding its modern restrictions, comprises nearly two hundred species, varying considerably in form.

They are distinguished by their general large size, varying from three-fourths to one inch and a quarter in length. They appear to be confined to moderate climes, being seldom or never found nearer than 30° to the equator. It has been stated by M. Westermann (*Silberm. Rev. Ent.* No. 3.) that no species of this genus exists in India. Mr. Hope has, however, described one, C. Wallichii, in his Synopsis of Nepaul Coleoptera (*Gray, Zool. Mis.* vol. i.). The Carabus monilis has been stated to reside in a chamber dug out in the earth of a garden, just sufficient to contain its body, and carefully smoothed and polished; formed, as it would seem, not by digging out the earth and removing it, but by the insect pushing its body forcibly against the walls of its cell. I should conceive, however, that these cells were the situations in which the insects had undergone their transformations. This insect appears to be fond of celery trenches. Mr. Sheppard once observed a specimen running cautiously round a small luminous Centipede, which it evidently wished, but feared, to attack. M. Von Winthem noticed, at the meeting of German naturalists in 1830, the occurrence of the larva of Tachina pacta, one of the parasitic Muscidæ, in the bodies of Carabus gemmatus and violaceus; and Walch describes a curious emigration of myriads of a species of Carabus, which he observed in the month of August (*Naturf. St.* xi.). The greatest confusion exists in the works of English entomologists relative to the specific names of many of the species of this genus, much of which might have been avoided had the original Linnæan specimens, preserved at the Linnæan Society, been collated with British individuals of the different species. It will be sufficient to state, that the Carabus hortensis *Linn.* is not a British insect.

The species of *Calosoma* are found upon trees, being furnished with ample wings, enabling them to obtain their necessary food, which consists of great numbers of the larvæ of Lepidoptera, their larvæ having also similar habits, as above detailed.

The species of *Nebria* are for the most part inhabitants of the sea-coast; whilst the Helobiæ, which are united with the former by French authors, are inland species, some frequenting the highest mountains. I have taken the H. Gyllenhallii on the summits of Snowdon. The structure of the mouth of Pelophila so nearly resembles that of Nebria, whilst its general form is similar to Blethisa, that the propriety of uniting the Elaphridea with the Carabidea appears evident.

The species of *Elaphrus* (*fig.* 4. 15. El. uliginosus) and *Notio-*

philus are of small size, and have the aspect of the Cicindelidæ. They are found in damp situations, and on the margin of streams, &c. running with velocity in the sunshine. The former genus is distinguished by the embossed spots on the elytra, and the latter by the brilliant smooth shining surface of their bodies. Mr. G. Waterhouse has published a monograph upon the latter in the *Entom. Magazine*, No. 2., in which he has described eighteen British species, some of which are not probably sufficiently distinct, Mr. Stephens having reduced their number to six. Amongst the exotic genera are to be mentioned Procerus *Megerle*, containing the largest species of the subfamily, having the labrum entire, and the anterior male tarsi simple. The species are few in number, and generally of a rich purple colour, with the elytra very rugose. They inhabit the mountains of Turkey and adjacent countries. The rare African genus, Tefflus, is also of large size, and resembles the Carabi in form, but the labrum is entire, and the thorax suborbicular. It has been generally considered allied to Procerus, but M. Brullé has removed it from the Carabides and placed it in his subdivision Panagiens, regarding it as more nearly allied to certain large exotic Panagæi. I have figured it in *Griffith's Animal Kingdom, Insects*, pl. 30. The interesting genus *Omophron* (*fig.* 4. 10. *O.* limbatum), whose larva I have above described, is of a rounded convex form, thus approaching the Dyticidæ; the thorax is short and slightly lobed behind, covering the scutellum; the basal joint of the male tarsi alone is dilated. The species are varied in their colours, with green and yellow; they are of small size, not exceeding one-third of an inch in length, and are found upon the banks of streams. The relationship of this genus to the Water-beetles has been pointed out above; but its true situation is evidently in this subfamily, which is confirmed by the similarity in its habits and the structure of its trophi with the Elaphridea and allied genera.

The fifth subfamily Bembidiides (Subulipalpi *Latr.*) is distinguished by the terminal joint of the maxillary and labial palpi being very minute and acute (*fig.* 4. 18. 19. maxilla and labium of Notaphus). The anterior tibiæ are always notched on the inside near the tip, and the insects are of small size, and generally ornamented with metallic tints (*fig.* 4. 17. Lopha 4-maculata). The typical genus, Bembidium *Latr.*, is nearly alli d in general characters to the

Elaphri and Notiophili, whilst other groups approach Trechus, amongst the Harpalides; indeed, Latreille and other French authors have placed the last-named genus in this subfamily; Brullé even giving to it the name of Trechides, although it ought evidently to be termed Bembidiides, Bembidium being certainly the typical genus. The minute size of some of the aberrant Harpalides appears to prove the propriety of considering the Bembidiides as a distinct subfamily, Nature evidently, in the former insects, departing from one typical form towards another; thus, in some of the genera allied to Trechus, placed at the end of the Harpalides, are found the maxillary palpi, terminated by an acute conical joint, which, in the typical Bembidiides, is very minute and pointed, and the size of the insects reduced to that of the Bembidiides. This peculiar structure of the palpi and minuteness of size are again exhibited in the genera at the head of the Dyticidæ; and hence, as well as from the subaquatic habits of the present group, it has been considered that the Bembidiides and Haliplus formed the connecting links between the land and water predaceous beetles. Many of the species are well figured by Sturm in his *Deutchslands Fauna*.

These insects are generally found upon the margins of streams, running about with great velocity, and burying themselves in crevices in the ground or under stones, &c.; hence at the time of high floods in winter the floating refuse is crowded with them, at which time the collector will not fail to obtain a rich harvest. They prey upon other insects as well as upon dead animal matter; thus Cillenum laterale, according to Mr. Haliday (*Ent. Mag.* vol. iv. p. 251.), is common under stones and tufts of sea weed on the Irish sea sands near low-water mark, and preys on Talitrus locusta, seizing it by the soft parts of the under side, and in this way being able singly to master game many times its own bulk. A great part of its existence is passed under the sea, and the mode in which it obtains the necessary supply of oxygen during its prolonged submersion is similar to that adopted by Aëpus fulvescens. The fore legs of Cillenum are very strongly spined, and in addition to the ordinary structure, the notch of the tibiæ is armed at its extremity with two spines at right angles below the notch, between which the end of the moveable spine at the basal angle of the notch is received, a structure evidently adapted to its mode of life.

Tachypus Andreæ, one of the most beautiful and rarest species, is often found feeding upon dead carrion on the coast of Ireland, as I am

informed by Mr. Davis. The species are comparatively numerous, but they require a more minute investigation into their specific characters than has hitherto been given to them. The genera are for the most part established upon the form of the thorax, the majority being considered by late French authors as sections only of the genus Bembidium.

The exotic genera do not offer material for particular observation.

THE second stirps of the predaceous beetles (Pentamera Adephaga) comprises those species which are aquatic in their various states, and are the HYDRADEPHAGA of *MacLeay* (Hydrocanthari *Latreille*), consisting of the Linnæan genera Dytiscus (Dyticus) and Gyrinus, in which the legs are formed for swimming, the two posterior pairs being flattened and fringed with hairs (*fig.* 5. 7.), the hind pair being placed at a considerable distance from the others, whereby a much greater impulse is given to the animal in its motions through the dense element of which it is an inhabitant. The body is oval, and generally depressed; the head broad and immersed in the prothoracic cavity; the mandibles short and strong, being nearly concealed by the upper lip; the eyes but slightly prominent; the inner lobe of the maxillæ curved from the base, and not articulated at the tip. The thorax broader than long, and the tarsal claws often unequal in size.

These insects swim with agility, occasionally rising to the surface for respiration, the feet at such times being held still and the body ascending, being specifically lighter than the water: in this situation they rest obliquely, the extremity of the body being protruded out of the water, whereby the air is enabled to enter the large space beneath the elytra and reach the spiracles along the sides of the back. When captured they emit an extremely disagreeable odour, arising from a fluid which they discharge; a white milky liquid is also often emitted. They occasionally fly during the night, at which times they are often attracted by a lighted candle. The larvæ are long and narrow; those of the Gyrinidæ are depressed, and those of the Dyticidæ convex, being composed of eleven segments, exclusive of the head, which is large and armed with two strong sickle-shaped jaws, a pair of short antennæ, four palpi, and six minute eyes on each side of the head; the first segment is the largest, and corresponds with the prothorax of the perfect insect, and almost similar in texture to the re-

mainder of the body. These larvæ respire by tracheal branchiæ, placed either at the anus or along the sides of the body, under the form of numerous small oar-like appendages. They quit the water previous to becoming pupæ, and construct an oval cell, in which they pass the latter state a few inches beneath the surface of the borders of ponds, &c., in which they had resided whilst larvæ.

Mr. MacLeay has remarked that aquatic insects do not differ so much in form as terrestrial; their numbers, as is especially the case in the present stirps, are also very considerably less, and consequently there are fewer genera amongst them, the exotic species being for the most part congeneous with our own, offering, as Latreille long ago remarked, "rien de remarquable;" moreover the European species are equal in size to, and occasionally larger than, those of tropical regions, of which but few have been received by collectors belonging to the larger and more typical genera; indeed M. Lacordaire states (*Ann. Sc. Nat.*, 1830.) that there are very few to be met with in Brazil. It is also a curious circumstance that, whilst the Dyticidæ are so much inferior in point of numbers compared with the Carabidæ, the Gyrinidæ are still less numerous in comparison with the former of these families, Dejean enumerating 286 species of Dyticidæ and only 37 of Gyrinidæ. The colours of these aquatic insects are generally dark olive, black, or brown, variegated occasionally with metallic tints and with markings of a dirty ochreous hue.

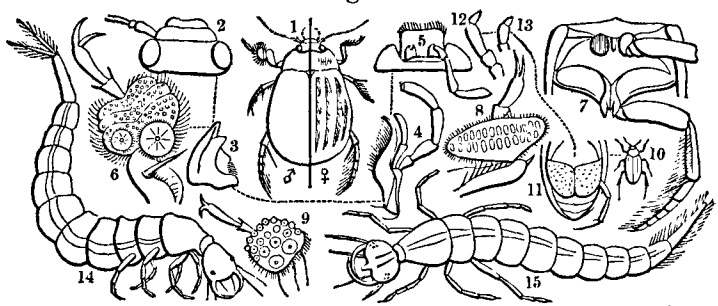
This stirps comprises only two families, which are very distinct from each other. MacLeay and Stephens, however, appear to regard the genus Haliplus (Hoplitus *Clairv.*) as the type of a third family, and which, from the small size of the insects and the structure of the terminal joints of the palpi, seems most nearly allied to the Bembidiides. Mr. Stephens, however, considers it to approximate rather towards the genus Omophron. Messrs. Kirby and Spence propose for these two families the names of Eunechina (swimmers), and Gyronechina, (swimmers in a circle), adding that the larvæ of the latter are the most perfectly Chilopodomorphous, and those of the former the least so. They have also added some valuable observations upon the affinities of these and some other allied groups, which want of space alone compels me to omit. (Vide *Introd.* vol. iv. p. 394.) Adopting the ordinary plan the two families will receive the names of—

1st, DYTICIDÆ (Diving-beetles); anterior legs short, antennæ long.

2d, GYRINIDÆ (Whirl-wigs); anterior legs long, antennæ short.

The first family DYTICIDÆ* *Leach* (Eunechina *K.* and *S.*) corresponding with the Linnæan genus Dytiscus†, is distinguished from the other families of Water-beetles by the antennæ, which are long and slender‡ (*fig.* 5. 1. Acilius sulcatus, divided down the centre by a line to show the peculiarities of the sexes), and by the articulated

Fig. 5.



external lobe of the maxillæ (*fig.* 5. 4.). They are of an oval, elliptic, or rounded form; of a very firm consistence; the head large and broad,

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† The incorrect Linnæan name, Dytiscus (derived from Δυτικός, urinatorius), has been rejected by most of our entomologists in favour of Geoffroy's name, Dyticus.

‡ The genera Agabus and Laccophilus offer partial exceptions to this character.

deeply immersed in the prothoracic cavity; the eyes large and but slightly prominent; the upper lip is transverse (*fig.* 5. 2. head of Dyticus marginalis); the upper jaws short and robust, with a strong internal tooth (*fig.* 5. 3. mandibles of Dyt. marg.); the lower jaws short, flat, and internally ciliated, with the tip acute; the outer lobe is palpiform, and is of nearly equal length with the jaw itself; the true maxillary palpi are about twice as long as the jaws (*fig.* 5. 4. maxilla of Dyt. marg.); the mentum is transverse, with the sides produced into two lobes; the under lip is short and square, and the labial palpi about twice as long as the lip and 3-jointed; when unemployed they are generally folded backwards (*fig.* 5. 5. labium, &c. of Dyt. marg.). The general structure of the mouth is more compact, and it is capable of being more closely shut than in the predaceous Land-beetles, a peculiarity beautifully dependent upon the opposing nature of the element in which these insects reside. The thorax is broader than long, and of equal breadth at its base with the elytra, its sides being rugose in the females of some species; the elytra are generally depressed, with deep longitudinal and pilose furrows in the females of some of the larger species; the prosternum is terminated by an acute point received into the emargination of the anteriorly produced and furcate metasternum (*fig.* 5. 7. meso- and meta-thorax of Dyticus, beneath). The anterior legs are lodged in a deep cavity on each side of the base of the prosternum; the legs are of moderate length, the anterior being the shortest and the posterior the longest; the tarsi are 5-jointed, the two posterior pairs being flattened and strongly ciliated, so as to be employed in swimming, being capable only of a horizontal motion (*fig.* 5. 7.). In many species the basal joints of the four anterior tarsi are dilated, whilst in some of the larger species the two anterior male tarsi have the three basal joints enlarged into a broad and nearly circular shield, convex above, fringed with fine hairs and cushioned beneath, or rather covered with a multitude of minute inverted caps, with several larger portions resembling suckers, varying in number and size in the various species (*fig.* 5. 6. anterior tarsus, Dyticus marginalis ♂, seen beneath; *fig.* 5. 8. ditto, Cybister ♂; *fig.* 5. 9. ditto, Hydaticus ♂). This structure enables the male to retain his situation upon the back of the female during copulation, the rugosities upon the thorax and elytra of the latter being also similarly serviceable. The elytra are furnished at the base, internally, with a pair of remarkable small circular membranous and ciliated

plates or alulets, which Dufour considers produce the humming noise which these insects have the power to make. The wings, which are large, exist in all the species. The spiracles are eighteen in number, the first pair being situated between the pro- and mesothorax, the second between the metathorax and first abdominal segment, and the seven remaining pairs upon the second to the eighth dorsal segments of the abdomen.

The Dyticidæ are found in all quarters of the globe, inhabiting stagnant in preference to running waters. They swim with great agility, the hind legs acting together in concert like those of a frog, the antennæ at the same time being erected, and the palpi concealed. (*Newman*, in *Ent. Mag.* vol. i. p. 315.) They are very voracious in their habits, attacking and devouring not only other aquatic insects, but are also occasionally very destructive to young fish in fish-ponds (Vide *Mag. Nat. Hist.* No. 12.). Mr. Anderson, the curator of the Chelsea Botanic Gardens, has also informed me that he has suffered much from these insects attacking young gold and silver fish, eating their dorsal and pectoral fins. Dr. Burmeister also mentions that a specimen of Cybister Röselii which he kept, devoured two frogs in the space of forty hours, and nevertheless, when he dissected it shortly afterwards, it was found to have entirely digested them, the intestinal tube being empty. They are very fearless in their attacks, seizing insects much larger than themselves. A specimen of Dyt. marginalis, which Esper kept in water alive for three years and a half, feeding it with raw beef, is recorded by Clairville to have destroyed a specimen of the large Hydrous piceus (although twice its own size) piercing it with its jaws on the only vulnerable point, viz. on the under side, at the insertion of the head in the thorax, and sucking its juices. Messrs. Kirby and Spence endeavour to account for the extraordinary duration of life of this specimen by supposing that it was caused by the celibacy of the insect. (See also *Mag. Nat. Hist.* No. 12. for observations on the tenacity of life exhibited by these insects). They employ their fore legs as claws in seizing and conveying their prey to the mouth; and Dr. Esper observed that his D. marginalis so completely sucked the blood out of the bits of meat with which he fed it, that they appeared only like small white masses floating in the water. Dr. Erichson, however, states that those which he kept alive refused to eat flesh, neither would they feed upon their companions unless one happened to die; and one, which De Geer kept, died in consequence

of having eaten a large leach which disagreed with it, large portions of it being discharged the following day, undigested, from the mouth. According to Esper and Erichson they are, however, able to fast for many weeks, and even months, but if they are kept out of the water they die in a very few days. It is also requisite for them to ascend repeatedly to the surface of the water for a supply of air for respiration, where they may be observed in sunny weather, resting with the extremity of the body protruded above the surface, and their legs extended at right angles. On approaching them, however, they immediately dive to the bottom. Esper also ascertained that they are very susceptible of atmospheric changes, indicated by their movements; thus, when the air is agitated they remain at the bottom, but rising by degrees and stationing themselves at different heights in the water, according to the calmness of the weather. Hence, their internal organisation will not allow them (like the fishes) to remain without access to the air; indeed, they may often be seen in a calm summer's evening creeping up rushes to take flight, rising into the air almost perpendicularly, until they are out of sight. Their descent is also perpendicular, dropping with considerable force into the water. It would also appear that it is by the reflection of the light upon the surface of the water that they are informed of a proper place for their descent, since I have several times observed specimens of various Water-beetles falling with violence upon glazed garden frames, and which they had evidently mistaken for water. The Rev. Mr. Bird has occasionally caught a Colymbetes, which has been attracted into a room by a lighted lamp in the evening. (*Ent. Mag.* No. 6.). On the ground their motions are rapid, although their fore legs alone can serve them as legs. Some, as the Laccophili, whose hind legs are thick, spring to a considerable distance. When laid upon their backs the quick muscular action of the hind legs gives them a whirling motion. The small species may occasionally be observed resting upon the flowers of aquatic plants, to which they have crept, either to luxuriate in the sun, or to gain an elevation previous to taking flight. They are to be found in all seasons of the year, but more frequently towards autumn. During the winter, some remain in the water, or bury themselves in the mud in a torpid state; others retain their agility, and may be seen coming to take the air in places where the ice is broken. I have even seen them swimming about in the water beneath the ice whilst I have been skating on the surface. Some also are

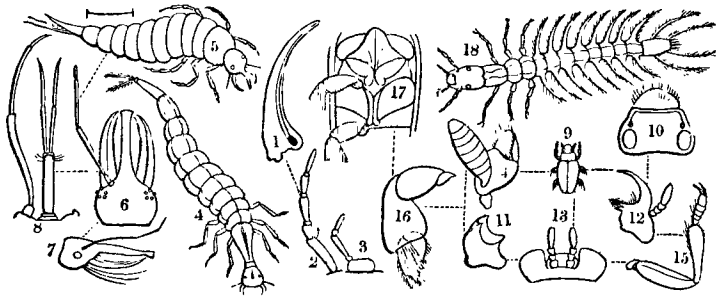
stated to leave the water and to hibernate beneath moss and lichens. The union of the sexes takes place in the autumn or at the beginning of spring; the female deposits her eggs from time to time, each laying consisting of from forty to fifty eggs, which are long and cylindric, and deposited in the water at random, the larvæ being hatched in the course of a fortnight.

The larva of Dyticus marginalis, according to Rösel, is very active, and when four or five days old is about four or five lines long, when it casts its skin for the first time. The second moulting takes place at about the same distance of time, and when the larva has increased about twice its former size, and it continues to grow and cast its skin (ten days intervening between each moulting, according to P. Lyonnet, *Mem.* p. 109.), until it is two inches long, when it has attained its full size (*fig.* 5. 14.). The exuviæ may often be observed floating on the water, with the mandibles and caudal appendages attached to them. These larvæ, which have long been known under the names of Squillæ or Shrimps, are of a dark ochre or dirty brown colour, with the body long and subcylindric, slenderer at each extremity, but more especially towards the tail, and consisting of eleven segments, exclusive of the head; the first nine segments are somewhat scaly above, but fleshy beneath; the first segment is longer and narrower than the following, and represents the prothorax of the imago; the sixth, seventh, and eighth are larger than the others, which are of nearly equal size; and the two terminal joints are long and conical, the apex being slightly truncate and scaly, with the sides fringed with hairs, whereby the insect is enabled to swim along in the water; these joints serving both as an oar and a rudder, and imparting a worm-like motion when the tail is moved in various directions. The terminal segment is provided with a pair of long and slender pilose appendages, whereby the insect is enabled to suspend itself at the surface of the water, which, as Swammerdam says, flows from them on every side, and thus the suspension is effected. These appendages, moreover, are tubular*, and communicate with the air vessels which run along the sides of the body, which is moreover furnished with sixteen spiracular points, which, however, from the observations of Lyonnet, appear to be but rudimental, not becoming aeriferous until the period when the insect puts off its larva state. The head in these larvæ is

* Latreille and De Geer, however, mention two additional bodies of small size and cylindric form, each having a distinct spiracle, and placed at the extremity of the body, at the base of the long and slender filaments.

large, oval, or rounded, and depressed, united to the following segment by a short neck, with five or six small elevated tubercles near the anterior angles, representing the eyes. They have two rudimental slender antennæ, about as long as the head, inserted in front of the eyes, and composed of seven joints, the first, third, fifth, and seventh of which appear to be merely nodules of the joints which they connect. The mouth is remarkably constructed, being destitute of the ordinary aperture, so that the insect may be, and indeed has been, described as wanting a mouth.

Fig. 6.



The mandibles (*fig.* 6. 1.) are very long, hollow, sickle-shaped, and acute, having a longitudinal slit near the extremity, so as to enable the larvæ to suck their prey, the juices running down the mandibles into the head. I have, however, discovered that this canal, which runs within the mandibles and may be easily distinguished, being apparently covered with a thin membrane only, externally terminates in a small circular aperture at the base, on the upper and internal edge of the jaws.* The maxillæ (*fig.* 6. 2.), which have hitherto been regarded as part of the external palpi, are slender, cylindric, and terminated by a short lateral spine ; the maxillary palpi being of equal thickness, arising from the tip of the maxillæ, and 7-jointed ; the lower tip (*fig.* 6. 3.) is short and bilobed ; and the labial palpi are slender and 4-jointed, the first and third joints being very short. These palpi, and the organs from which they arise, must here necessarily, from the closing of the mouth, be employed only as feelers. The muscles with which the mandibles are moved are of a very large size, occupying almost the entire of the interior of the head ; when unemployed, these jaws are closed upon each other in front of the head, which then appears nearly

* De Geer, after describing the suctorial structure of the mandibles, has suggested that the insect must be provided with some other means of taking food, as he observed one of the larvæ not only suck the juices of an aquatic Woodlouse, but also devour, by small degrees, all its solid parts.

straight in front. The legs are rather long, slender, and ciliated on the inside, serving as oars when swimming quickly; the body is carried in a straight line, but when they stop to breathe or to seize their prey, they assume the shape of the letter S. During the summer the larva is said to attain its full size in about fifteen days, and then quits the water and creeps into the neighbouring earth, where it forms, with considerable skill, a round cell, in which, in about five days, it changes to a pupa of a whitish colour, with two obtuse points at the extremity of the body. It appears in the perfect state in about a fortnight or three weeks; those individuals, however, which became pupæ in the autumn, do not appear as Beetles until the following spring. The Beetle is at first soft and yellowish, but it soon hardens and becomes darker coloured; it is not, however, until the end of eight days that it has acquired its proper consistency. Figures of the larva and pupa of Dyticus marginalis are given by Rösel, *Insect. Belustig.* vol. ii.; *Ins. Aquat.* tab. 1.; Lyonnet, *Posth. Mémoires*, vol. i. pl. 11.; Swammerdam, *Book of Nat.*, pl. 29.; Mouffet, p. 320.; Kirby and Spence, vol. iii. pl. 18. f. 5. See also a Memoir by Lancret and Miger in the *Bullet. Soc. Philom.* No. 32. In the *Transactions of the Entomological Society* of London (vol. i. p. 86.), it is stated that the larva of a Dyticus had been forwarded to Mr. Curtis, which had been voided by a female who had been long subject to convulsions.

The larva of Cybister Röselii (figured by Rösel, loc. cit. tab. 3.), is longer and more slender (*fig.* 5. 15.) than the preceding; the front of the head has thin pointed processes, the central one being supposed by Rösel, but evidently erroneously, to be the rostrum; the extremity of the body is also destitute of the two pilose appendages above described, and the corresponding caudal tubercles of the pupa are wanting, the head of the latter is also furnished with a transverse ridge, having several small teeth on its edge.

The larva of Acilius sulcatus (*fig.* 6. 4. Rösel, loc. cit. tab. 3., and De Geer, vol. iv. tab. 15.) is much smaller than that of Dyt. marginalis; its head is rather longer behind, and the first segment of the body is considerably lengthened, forming a narrow neck; the body is more continuous, the segments not being separated by incisions; the neck is generally bent downwards, and the head turned rather upwards, the parts of the mouth having also the latter direction, so that the animal has the appearance of a small snake. It is extremely insidious in its attacks; the position of the neck and head inducing

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it to seize objects above rather than in front of it; so that when an object is perceived floating on the surface of the water, the larva rises very cautiously until it has nearly reached it, when, by a sudden jerk of the neck, it seizes the object with its jaws, and immediately drags it under water; if it still struggle, the larva endeavours to dispatch it by repeated jerkings of the head. When in the water they may constantly be perceived jerking themselves in every direction, probably for the purpose of seizing upon other minute insects.

The larvæ of the genus Colymbetes differ from the preceding in the large size of the quadrate anterior segment of the body; the two caudal processes are also much longer. But the most singular larvæ in the family are some of small size (*fig.* 6. 5.), which I have found in the neighbourhood of London, and from which the Rev. F. W. Hope, (who has paid great attention to the tribe of Water-beetles) informs me that he has reared Noterus crassicornis. They are of an elongate oval shape, attenuated towards the posterior extremity; the head (*fig.* 6. 6. seen from above, 6. 7. seen sideways) is produced in front into a slender beak, longer than the rest of the head, the jaws meeting together at its tip; the terminal segment is furnished with the two long ordinary filaments, between which the segment itself is produced into a long and acute point. The maxillæ and labium are represented with their appendages in *fig.* 6. 8. These larvæ are brown, with two ochreous bands across the back. They are about a quarter of an inch in length. I have also found another larva of a smaller size than the preceding, in which the produced part of the head is shorter and more robust, the terminal segment produced but very slightly between the caudal filaments, which are very long: this larva is of a dull pale colour, with two irregular, longitudinal, dark markings down the back.

As to the affinities of the present family with the Carabidæ on the one hand, and the Gyrinidæ on the other, entomologists seem to be entirely agreed. Many links in the chain, it is true, remain to be discovered, the larvæ being also of a totally different appearance.

Mr. MacLeay considers that an obvious analogy exists between the larvæ of this family and of the Neuropterous genus Hemerobius, and as the former are not furnished with the lateral branchial appendages of the Gyrinideous larvæ, their appearance is much less scolopendriform

Clairville, Leach, Erichson, and others, have made this family the subject of especial memoirs; and by these authors various plans of classification have been proposed, and upon which the distribution of the British

genera given in my Synopsis is founded, and which appears more natural than any previously proposed, by bringing together all the small species without a visible scutellum, and by removing Pœlobius to its legitimate station, as pointed out by Latreille, near to Colymbetes.

Amongst the British insects of which the family is composed, the genus Haliplus (*fig.* 5. 10. H. elevatus) is distinguished by having the maxillary and labial palpi (*fig.* 5. 12. 13.) terminated by a short subulated joint, and especially by the extraordinary dilatation of the posterior coxæ (*fig.* 5. 11.). Some of the species of Hyphidrus and Hydroporus vary considerably in the appearances of the sexes: their variations have been generally regarded as specific distinctions; thus, in Hyphidrus ovatus, one of the sexes (Hyd. gibba *Fabr.*), has the elytra sericeous, whilst in the other (ovalis *Fabr.*) they are glabrous; the individuals of the latter sex being also much larger than the former. But a difference of opinion exists as to the precise sexes of these respective individuals, Gyllenhal regarding the former as males and the latter as females, and Erichson and Dejean maintaining a different opinion. The larger size of the latter, indeed, leads to the supposition that they are females, whilst, from analogy with the larger species of the family, the glabrous elytra of the same individuals would indicate the male sex; and the anterior tarsi in these are dilated, whilst in the others they are compressed; the latter character is also found in Hydroporus memnonius *Nicol.* (niger *St.*, jugularis *Bab.*), and some others, in which the sexes are similarly variable in the appearance of the elytra; but in these the sexes are of nearly equal size.

Pœlobius Hermanni, a common species, is remarkable for the noise which it makes when held in the fingers, by friction of its abdomen against the elytra.

Acilius sulcatus is another species which possesses the power of making a noise. Frisch states that this is produced under water; but a specimen of the insect which I kept some time (and which I had caught on the ground, having fallen whilst flying upon some glass-panes which it had evidently mistaken for water) was equally noisy when confined in a box in the sunshine, making a loud humming for a considerable time, without ceasing, and without my being able to perceive the slightest motion of the abdomen against the elytra; hence I conjecture that it might be produced by the action of the air upon the alulets, which is also the opinion of Dufour. This insect, moreover, is able to leap to a considerable height, when laid upon its back,

by striking violently with its hind legs upon the ground. The thorax of the female of this species is stated by Messrs. Kirby and Spence to have a transverse and hairy furrow (*Introd.* vol. iii. 305.); there is, however, merely a triangular patch of hairs on each side, and several small oblong pores, from whence the insect causes a milky fluid to exude when captured.

The genus Dyticus as now restricted, comprises the largest species of the family, the colour of which is black tinged with olive, the margins of the thorax and elytra being luteous. They are almost exclusively European. Some of the species exhibit a very remarkable anomaly, certain individuals having the elytra destitute of furrows, as in the males, the anterior tarsi being, nevertheless, not patelliform. Bonelli, however, ascertained by dissection, that these individuals were females, and Ahrens took one of them paired with an ordinary male. Mr. Stephens, accordingly, gave them as distinct species under the names of conformis? *Kunze*, and circumcinctus *Ahrens* (*Stephens*, vol. ii. pl. 12. f. 6.); and Mr. Kirby, who at first thought these individuals might be neuters, raised them, subsequently, to the rank of a genus under the name of Leionotus. Mr. Curtis, however, considers the latter species (which he misnames flavo-maculatus) as a variety of the female of D. angustatus, and Ahrens described one of these smooth-backed individuals as a "varietas problematica" of the female of Dyticus marginalis, whilst Dr. Erichson considers that there are three modifications in the character of the females in this genus:—1st, those differing from the males (D. latissimus, dimidiatus, &c.); 2d, those similar to the males (D. circumflexus, *Fabr.*); and 3d, those which are liable to variation, being either different or similar to the males (D. marginalis *Linn.*, and conformis *Kunze*, D. circumcinctus *Ahr.*, and dubius *Gyll.*, D. lapponicus *Payk*, and septentrionalis *Gyll.*). An intermediate kind of individuals has also been described by Erichson, in which the sulcations and punctures of the elytra are obsolete; and an apparently similar individual has also been noticed by M. Guyot (*Annal. Soc. Ent. de France*, 1837. p. 16.). In the neighbourhood of Berlin both kinds of females of D. circumcinctus are found promiscuously, elsewhere one or the other variety is occasionally wanting; thus in the lakes near Magdeburg, amongst many thousands of Dyt. circumcinctus, not a single female with sulcate elytra could be found. Gyllenhal indeed has described a closely allied species (D. septentrionalis) as possessing simple anterior tarsi

in both sexes; but Erichson conceives there must be some error in this. The Rev. F. W. Hope possesses a most remarkable hermaphrodite specimen of this genus, one side having male, and the other partial female characters.

There has been considerable confusion introduced into the nomenclature of the species of this genus, Linnæus having led the way by reversing the sexes of D. marginalis. The British species may be easily distinguished by the form of the two points which terminate the posterior coxæ (ordinarily misnamed the sternum, *fig.* 5. 7.). Notwithstanding their large size, these insects are subject to the attacks of a minute parasite, described by M. Audouin (*Bull. Soc. Philom.*, 1822, and *Zool. Journ.*), under the name of Achlysia Dytisci, but which the recent investigations of M. Duges have proved to be the immature state of one of the Water-mites (Hydrachnæ), and which affixes itself to the thin membrane with which the upper surface of the abdomen is covered. (See also *Burmeister in Isis*, 1834).

The large exotic species belong almost exclusively to the genus Cybister *Curtis*, of which a single species only is European (C. Röselii, an extremely rare British insect). The remainder are distributed over very wide tracts of country; thus one species is found in Guinea, the Cape of Good Hope, Madagascar, the Mauritius, and the Indian Archipelago; and in like manner, according to Dejean, Eunectes sticticus is found in India, the American Islands and France. The other exotic genera do not merit any particular notice.

The family GYRINIDÆ*, corresponding with the Linnæan genus Gyrinus, consists of a small but remarkable group of beetles, which,

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* BIBLIOGR. TO THE GYRINIDÆ.

Forssberg. Nova Acta. Acad. Upsal. vol. viii. (Descriptions of 24 species).
Modeer, in Vetenskeps, Acad. Handl. 1770.
Klug, in Symbol. Physic. and Coleopt. Madagascar.
Dufour. Annal. Sc. Nat., Oct. 1824. (Internal Anatomy.)
Sturm. Deutchsland's Fauna, vol. x.
Laporte. Etudes Entomologiques, p. 2.
Audouin and Brullé. Hist. Nat. vol. v.
Erichson. Kafer du Mark. Brandb.

in the structure of their antennæ, trophi, and legs, especially merit attention. The body of these insects is generally ovate or elliptic, and more or less depressed; (*fig.* 6. 9. Gyrinus (Orectocheilus) villosus, *fig.* 6. 10—17. details of the same insect), the head (*fig.* 6. 10.), is of a moderate size, and somewhat triangular, deeply immersed in the cavity of the prothorax, and furnished with two pairs of eyes, one of which is placed on each side on the upper, and the other on the lower, surface of the head. The antennæ (*fig.* 6. 14.) are inserted in a cavity in front of the eyes, and are very short; the basal joint is minute, the second large, globular, and produced externally into a long earlike process, with the margins ciliated; the remaining joints, apparently eight or nine in number, being very short and closely united together, forming a fusiform mass. The upper lip (*fig.* 6. 10.) is large, horny, and ciliated; the mandibles (*fig.* 6. 11.) are short, horny, and strongly notched; the maxillæ (*fig.* 6. 12.) are flat, horny, curved, acute at the tip, and ciliated internally, with a prominent lobe below the centre; in the restricted genus Gyrinus (G. natator) the maxillæ are also provided with a slender exarticulate lobe, but in the large exotic species, as well as in (G.) Orectocheilus villosus, this lobe is entirely wanting; the maxillary palpi are very short, and 4-jointed, the three basal joints being minute, and the third large and ovate. The mentum (*fig.* 6. 13.) is large, horny, and bilobed, the labium occupying the space between the two lobes; the labial palpi are short and 3-jointed; the thorax is short, transverse, rather wider behind, and closely applied to the base of the elytra, which are rather broader than the former; the scutellum is very minute, and occasionally indistinct. The terminal segment of the abdomen extends beyond the elytra, and is furnished with two small cylindrical lobes, which the insect has the power of retracting at will. The fore legs (*fig.* 6. 15.) are long and of the ordinary form, except that they are more elbowed, which gives them the appearance of arms enabling them to seize their prey; the four posterior legs (*fig.* 6. 16.) which are used as oars, are, however, very short, rarely extending beyond the side of the body, quite flat and considerably dilated, the

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Ahrens. Neue Schrift. Naturf. Gesellsch. zu Halle, vol. ii.—Ditto, Fauna, fasc. ii.
Say, in Trans. Amer. Phil. Soc. vols. ii. and iv.
And the general works of *Stephens, Gyllenhal Fabricius, Olivier, Perty, Germar* (Ins. Sp. Nov.), *MacLeay* (Annul. Javan.), *Chevrolat*.

femora and tibiæ being trigonate, the latter with short flattish ciliæ at the external apical angle, and with the three basal joints of the tarsi (which are 5-jointed) produced on the inside into long, flat, ciliated leaf-like lobes; the fourth joint is of similar size and form; but the terminal joint, which is very short, is attached near the extremity of the latter, the intermediate tarsi being provided with a pair of short ungues, and the posterior pair having only a single and almost obsolete claw; the anterior tarsi are large and dilated, with two strong claws, the male tarsi being flat beneath, and covered with numerous minute granulations and margined with a minutely serrated cilia. The hind legs are very transparent, presenting an excellent object for the microscope, exhibiting very distinctly the circulatory system in numerous convoluted veins. From the apparently equal action of the two posterior pairs of legs, the meso- and metasternums are nearly of equal size, the posterior coxæ being very greatly enlarged (*fig.* 6. 7.).

These beetles are almost the only water insects which exhibit a brilliant metallic lustre, a peculiarity dependent upon the habits of the insects which generally swim upon the surface of the water.

With the exception of a few exotic genera, the Gyrinidæ are of a small size, not exceeding one third of an inch in length, the largest even not being one inch long.

These insects cannot fail to have attracted the attention of every person when passing near standing, or gently running, water, on the surface of which they are to be seen in groups, varying in number from a couple to several hundreds, whirling about in every direction, but generally in circles, whence they have obtained the English name of Whirlwigs, and the French one of tourniquets. When thus occupied, their motions are so exceedingly quick, that the eye is perplexed in following them, and dazzled by the brilliancy of their wing cases which glitter like bits of polished silver or burnished pearl. These dances are kept up throughout the year, even during the winter, as the insects may be thus observed on fine days, whenever the water is not covered with ice. It has indeed been said that they retire in the autumn and repose in a dormant state during the latter season, attached to the roots of aquatic plants, or in the mud at the bottom of the water: on approaching them, they instantly take alarm, and dive beneath the surface, carrying with them a little bubble of air, which glitters like a drop of quicksilver, and is attached to the posterior portion of their bodies. Sometimes they may be taken flying, their large wings en-

abling them to change their abode without difficulty, when the drying up of their native pool compels them to emigrate. This will enable us to account for the occasional discovery of these insects in small puddles of newly-fallen rain-water. The structure of the short hind legs, and especially of the curious branched tarsi, must be examined, in endeavouring to account for the singular motions of these insects*; the assembling together of which has been regarded by some writers as resulting purely from a strong social influence, and by others, as indicating no closer bond than that of animals congregating round their common food. That the food of the Gyrinidæ consists of small dead floating insects, I have ascertained; but I would further suggest that, being produced on the same spot, as is the case with the swarms of midges, they are influenced, in some degree, by the common desire of continuing their species. I have often observed that, in their gyrations, they hit against one another. In dull and inclement weather, they betake themselves to quiet places, under bridges, or beneath the roots of trees growing at the water's edge. When touched, they emit a disagreeable odour, arising from a milky fluid, which is discharged from the pores of different parts of the body, or, according to De Geer, from the two minute retractile lobes at its extremity. It seems not improbable that this fluid, united with the high polish of the body, may have the effect of resisting the action of the water. It appears, however, that G. minutus and O. villosus are scentless. (*Kirby and Spence*, ii. 242.) The remarkable structure of the eyes, which, unlike those of the majority of insects, consist of two distinct pairs, one on the upper, and the other on the lower, surface of the head, must be greatly serviceable to the insect in the peculiar situation in which it is generally observed, and whereby it is enabled to see objects beneath it in the water, and above it in the air.

The female, shortly after impregnation, deposits her eggs, which are small, and of cylindrical form, and placed end to end, in parallel rows, upon the leaves of aquatic plants; and from which, at the end of eight days, the larvæ are produced. De Geer (*Mémoires*, vol. iv.) and Rosel (*Abhandl.* vol. iii. suppl. tab. 31.) succeeded in obtaining these larvæ from eggs deposited by the females; but Modeer (*Mem. Acad. Reg. Suec.* 1770) is the only author who has traced the insect through

* "Mr. Briggs observes, that the G. natator moves all its legs at once with wonderful rapidity, by which motion it produces a radiating vibration on the surface of the water." — *K. and S.* ii. 364.

its different states. The larva (*fig.* 6. 18.) is long, narrow, and depressed, and nearly resembles a small centipede, of a dirty white colour, composed of thirteen segments (including the head), separated from each other by lateral incisions; the head is large, oval, and depressed, armed with two strong jaws, two short filiform 4-jointed antennæ, several small tubercular eyes (the number of which De Geer could not discover), forming a group on each side the head, and slender maxillary and labial palpi; the clypeus is deeply notched in front, without any distinctly articulated labrum; to each of the three anterior segments of the body is attached a pair of moderately long and slender legs; and from each side of each of the eight following segments arises a long, slender, transparent, and membraneous filament, bent rather backwards, and terminating in a point; the terminal segment is furnished with two pair of similar but much longer appendages. These filaments are employed as organs of respiration, each being internally provided with a delicate air-vessel, connected at the base with the ordinary lateral tracheæ; the body is terminated by four minute conical points, bent downwards, and which are used by the insect when in motion; whereas the long filaments have no peculiar motion. When the larva has attained its full size, at the beginning of August it creeps out of the water, up the stems of the rushes, or other aquatic plants, where it encloses itself in an oval cocoon, pointed at each end, composed of a substance spun out of its own body, and somewhat resembling grey paper, within which it becomes a pupa, in which state it remains about a month, when it makes its appearance in the perfect state, and immediately resorts to its native element, the neighbouring water. Mr. R. Patterson of Belfast, has communicated to me the discovery of a specimen of Orectochilus villosus inclosed in a fresh-water shell taken out of a pool, the mouth of which was stopped with a piece of some plant, with slime, and which was lined with a soft, whitish, silky substance, extending to the margin of the aperture. It was supposed that the larva had taken possession of the empty shell, in which to undergo its transformations. (See also *Ent. Mag.*, ii. p. 530.) Mr. H. W. Griesbach has, however, discovered the whitish silky cocoons of this species beneath the bark of a rotten willow tree, at a yard's distance from the edge of a river, and about two feet from the ground. (*Ent. Mag.* iv. p. 254.)

The Gyrinidæ were at first united by Linnæus with the Dyticidæ; but this author subsequently adopted the genus Gyrinus, as proposed

by Geoffroy, and, until recently, the group has been kept entire. From this family they are at once distinguished by the shortness of the antennæ, whilst the shortness of the palpi and the structure of the legs separate them from the other water beetles, Hydrophilidæ. Latreille, indeed, in his *Genera*, &c., separated them from these groups, uniting them with the Parnidæ, in a family to which he gave the name of Otiophori; but he was subsequently convinced that their relationship with the last-named family was merely one of analogy; and even in his *Genera*, he suggested that they formed the connecting link between the Dyticidæ and Hydrophilidæ, a situation now assigned to them by British entomologists.

Mr. MacLeay, in the *Annulosa Javanica*, proposed the separation of some of the large exotic species, in consequence of their apparent want of a scutellum; and, still more recently, Messrs. Brullé, Laporte, and Eschscholtz have introduced numerous other genera.

The species of this family are very limited in number, not more than fifty or sixty existing in collections; some of the species are found upon the margin of the sea, whence, indeed, one species (G. marinus) acquires its specific name. One species (G. limbatus) has been communicated to me by M. A. Lefebvre, by whom it was discovered near the summit of Mount Etna, in the region of perpetual snow. Other species are very widely distributed, especially certain Dyneutes, all of which are strangers to Europe, but inhabit the remainder of the Old Continent. The genus Gyrinus appears more exclusively to inhabit Europe and North America. I have, however, received several species of the last-named genus from Messrs. Desjardins and Templeton, which inhabit the island of Mauritius.

The type of the genus Gyrinus is the well known Whirlwig, or Water-flea; that of Orectocheilus is a curious insect, which appears to be less gregarious than the other species. Nicolai says of it, "In superficie Salæ frequens, nocte vividus videtur." (*Dissert. Inaug.* p. 36.) According to some observations made by M. Robert of Liege, and communicated by M. V. Audouin to the Entomological Society of France, this species is only to be observed running about on the surface of the water during the night, hiding itself under stones on the banks by day, and even, if forced into the water, immediately striving to gain the shore, never diving, like the other species, to the bottom. Mr. Howitt has also published some observations on this species in his *Book of the Seasons*, and which, together with the circumstances

mentioned above, observed by Mr. Patterson, will be sufficient to show the necessity of separating this insect from the other Gyrinidæ. The exotic genera do not require any especial notice.

The second subtribe of the Pentamerous beetles, forming the tribe Chilopodomorpha *MacL.*, has been termed by Mr. Stephens, RYPOPHAGA (or Cleansers), from the important offices assigned to its various members, of removing animal and vegetable substances in a state of decomposition; and is distinguished by having only four palpi, viz. the labial and external maxillary, the internal maxillary palpi being represented by the dilated external lobe of the maxillæ, which here loses its palpiform appearance, although occasionally evidently articulated, and acquires the typical structure of the Coleopterous maxillæ. The antennæ are also of a more complex structure, being either gradually or abruptly clavate, and the basal joints of the male tarsi are generally more or less dilated.

This subtribe appears to comprise the three following stirpes: —

PHILHYDRIDA, typified by the genus Hydrophilus.

Elytra covering the abdomen; legs subnatatorial; antennæ capitate.

NECROPHAGA, typified by the genus Silpha.

Elytra generally covering the abdomen; legs cursorial; antennæ often capitate.

BRACHELYTRA, typified by the genus Staphylinus.

Elytra very short, not covering the abdomen; legs cursorial; antennæ gradually clavate.

But it is evident that several of the families placed by Mr. MacLeay in the Chilognathiform (Iuliform) tribes, ought to find a station amongst the Necrophagous Rypophaga.

The stirps PHILHYDRIDA MacLeay (or lovers of water) is composed of insects having either aquatic or subaquatic habits, residing in the water, or in the damp margins and shores of streams and ponds. They are distinguished from the other water-beetles by the shortness of their clavate antennæ, which often (although only, perhaps, in appearance) possess fewer than the general number of joints, and by the ordinary great length of their maxillary palpi, whence the typical groups have been named Palpicornes by the French entomologists; the man-

dibles are short but very robust; their bodies generally of an oval form; the hind legs are ciliated, and formed for swimming, or rather paddling, in the majority; and the tarsi are variable in the structure of their joints.

Mr. MacLeay divides this stirps into the five following families: —

Normal group? Palpi shorter than the antennæ.	Heteroceridæ?	
	Parnidæ.	Analogous to the Gyrinidæ.
Aberrant group? Palpi at least as long as the antennæ.	Helophoridæ.	
	Hydrophilidæ.	Analogous to the Dyticidæ.
	Sphæridiidæ?	

To these Mr. Stephens has added two others, viz. —

Limniidæ (subsequently described as portion of the family Parnidæ).
Anisotomidæ (Agathidiidæ *Westw.*),

but until these various groups be strictly analysed, and entomologists made acquainted with their larvæ, the distribution and arrangement of the families cannot be considered as fixed. The Hydrophilidæ, however, appear to be the typical family; although, in their strict natatorial habits, general appearance, and, more particularly, in the circumstance that some of the true Hydrophili recede from the Rypophagous habits of the family, and feed in the larva state, according to M. Illiger, upon aquatic mollusca and larvæ, it is evident that they approach more nearly towards the predaceous Dyticidæ, although, when arrived at the perfect state, they become more perfectly herbivorous, whilst the Heteroceridæ, Anisotomidæ, and Sphæridiidæ evidently conduct us towards other groups.

In the *Règne Animal* we find these insects far removed from the Dyticidæ*, and employed to establish a passage between the Clavicorn and Lamellicorn Beetles, in the following arrangement: —

Second Section of Clavicornes.	Tribe 1.	Heterocerus.
	Tribe 2.	*Parnus, &c.
		**Elmis (Limnius), &c.
Palpicornes.	Tribe 1.	*Helophorus, &c.
		**Hydrophilus, &c.
	Tribe 2.	Sphæridium.

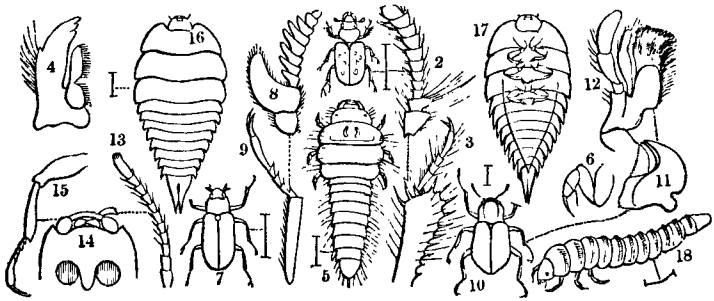
I have, however, preferred following in the steps of MacLeay and Stephens, by introducing the Philhydrida between the Hydradephaga

* In the *Familles Naturelles*, we find the following note, relative to the affinities of these insects: — "Les palpicornes conduisent par un bout aux macrodactyles (Elmis, &c.), et par l'autre aux sphéridies, aux bousiers, &c. Les Dryops, genre de la tribu des macrodactyles, semblent se lier avec les gyrins de ceux-ci on passe aux Dytiques et de-là aux carabiques." (P. 365.) In the *Règne Animal* (vol. i. p. 519.) we also find various observations in support of the nearer relation of the Hydrophilidæ to the Necrophaga and the Lamellicorns, than to the Dyticidæ.

and the Necrophaga (the passage to the latter being effected by means of the Anisotomidæ), although I cannot but think that the Philhydrida are quite as nearly allied to some of the other Clavicorn families; indeed, I would suggest that it would not be very unnatural to introduce the Brachelytra between the Philhydrida and Necrophaga, commencing their arrangement with the Pselaphides, which, in the great development of their palpi, resemble some of the Helophoridæ (Hydræna), and terminating with the Staphylinides, which are so nearly allied to the typical Silphidæ. By this means the Dermestidæ and Byrrhidæ would be brought together. Mr. Kirby, however (*Faun. Bor. Am.*), has made the Brachelytra intermediate between the terrestrial Adephaga and the Necrophaga, placing the Philhydrida between the aquatic Adephaga and the Necrophaga, and thus completing a circle.

The family HETEROCERIDÆ* (Acanthopoda *Latr.*), as above stated, comprises insects receding considerably from the type of the present stirps; neither do they offer any marked relationship with the Hydra-

Fig. 7.



dephaga, nor even with any of the other Philhydrida, although their subaquatic habits resemble those of the Parnidæ. They are of small size, with the body depressed (*fig.* 7. 1. Heterocerus lævigatus); the

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* BIBLIOGR. REFERENCES TO THE HETEROCERIDÆ.

L. Dufour. Sur les Acanthopodes, in Ann. des Sc. Nat. 2d series, vol. i.

Say, in Journ. Acad. Nat. Science, Philad. vol. iii.; and the works of *Fabricius, Stephens, Curtis, and Gyllenhall, &c.*

The reference, by Latreille, to the Journ. d'Hist. Nat. et de Physique (in the Gen. Crustac. &c. noticed by Brullé) is incorrect, as Latreille himself noticed in Gen. Crust. &c. vol. iv. Append.

legs broad, compressed, and serrated (*fig.* 7. 3.); the thorax much narrower than the elytra, especially at its hinder part; the jaws robust, toothed, and advanced (*fig.* 7. 4.); the antennæ (*fig.* 7. 2.) short, with the two basal joints large, and the remainder forming an elongated club; the palpi very short; the tarsi are short, and 5-jointed, the basal joint (overlooked by Curtis and MacLeay) being minute and oblique; this part of the leg is capable of being folded back upon the tibiæ when the insect is engaged in making its burrows, which are formed, by the assistance of the broad flat spinose tibiæ, in the mud of the banks of ponds or stagnant water, out of which the insects make their escape when the earth is shaken or stamped upon, and again as quickly burying themselves in the mud. It is in similar situations that the larva was discovered by Miger*; I am not, however, aware that any description has been hitherto published of it. Mr. Ingpen has communicated to me a larva, several of which he found upon damp mud, in situations where he had taken Heterocerus marginatus, and of which I have given an outline (*fig.* 7. 5.): the head is broad; the eyes small, and placed behind the mandibles, which are strong, bent, and toothed at the tip; the three thoracic segments are large, and wider than the head, and the nine abdominal segments are much narrower, and subcylindric; the legs are strong, and armed with a robust hook (*fig.* 7. 6.); the body is clothed with long hairs. The situation in which these larvæ were found, and their general structure, lead me to regard them as those of Helerocerus marginatus.

From the advanced structure of the head of the imago, and the strength of the trophi, it is supposed that the habits of these insects must be carnivorous; and Mr. Curtis mentions that one of the species was met with under small dead crabs, left by the tide, beneath which they were burrowing into the sand. The bodies of these insects are clothed with a fine silky pubescence, whereby the action of the water upon their various parts is prevented. They walk but slowly; in the hot sunshine, however, I have observed them raise their wings, fly off, and again alight, with all the agility of the tiger-beetles. Their mode of walking is rather peculiar; the anterior parts of the body being considerably elevated. Mr. Curtis notices the variations of breadth of the thorax, as probably indicating sexual distinctions. We are indebted to M. Léon Dufour for an admirable memoir on the ex-

* Kirby and Spence (*Introd.* vol. ii. p. 294.) introduce Heterocerus in a list of Coleopterous genera having *aquatic* larvæ. I know not upon what authority.

ternal and internal anatomy of this genus. The family comprises the single genus Heterocerus.

The French entomologists regard the variations exhibited by the European individuals of this genus as indicating only varieties of a single species.

Fabricius describes a species from Tranquebar, and Harris mentions an American species; Dejean unites the North American species, H. pallidus *Say*, with the common European species.

The family PARNIDÆ MacLeay (or Macrodactyla *Latr.*), like the preceding, is composed of minute subaquatic insects (*fig.* 7. 7. Dryops Dumerilii), distinguished by their narrow and unarmed tibiæ and moderately long tarsi, which are formed for walking alone, the terminal joint being very long, and armed with two strong claws at the tip (*fig.* 7, 9. tibia and tarsus of Parnus). The body is oval or oblong, and more or less convex, with the posterior part of the thorax as broad as the base of the elytra. The antennæ are variable in their form, but are always short; the upper and lower lips are large, the latter equalling the mentum in size; the palpi are very short, with the terminal joint rather thicker and longer than the preceding; and the mandibles are robust, notched at the tips, with the inner surface ciliated.

The mode of respiration of these insects has been the subject of controversy; M. Audouin considering it to be effected as in the Aëpus fulvescens, whilst M. Wesmael, at the Academy of Sciences at Brussels, has observed that the upper surface of the body of Elmis is glabrous, and consequently unable to retain a coating of air; the under surface is, however, furnished at each side with a broad longitudinal band, contiguous to the lower margin of the elytra, formed of a silky coat; the body of the Parnus is, on the contrary, entirely villose, so that it is probable that the entire body is surrounded with a coat of air when the insect is under water. (See *Ann. Soc. Ent. Fr.* 1835, p. xl.)

This family comprises two divisions, which have been formed by Mr. Stephens into families; but as they agree in many of their essential characters, I have followed Latreille and MacLeay in considering them as constituting a single family, composed of two subfamilies, viz. the Parnides and the Elmides.

The distribution of the groups composing this and the preceding

family (which Gyllenhal unites together under the name of Amphibii), proposed by Latreille in the *Règne Animal* (vol. iv. p. 514. note 2.), and founded chiefly upon the structure of the antennæ, does not appear so natural as that given in the body of that work; Heterocerus and Parnus being, in the former, united together, the latter being separated from Elmis. Mr. MacLeay considers Potamophilus as leading to Octhebius amongst the Hydrophilidæ, and that Georyssus may be of service in effecting a passage between the Heteroceridæ and Sphæridiidæ.

The subfamily *Parnides* * (or family Parnidæ *Stephens*) is distinguished by the very short antennæ (*fig.* 7. 8. antenna of Parnus), of which the third and following joints compose a subcylindric, curved, and subserrated mass; the body is smooth and woolly, and of an oblong form.

These insects, like the preceding, inhabit the borders of ponds and ditches; they are well defended from the action of the water by the woolly kind of covering of their bodies. I have observed them, when thrown upon water in the hot sunshine, make use of their wings in endeavouring to regain the shore, without, however, rising from the surface of the water, but sliding, as it were, along, and stopping occasionally to rest, and then closing the wings. Latreille presumes, from the structure of the jaws, that they feed upon animal matter. They burrow in damp loose earth, amongst the roots of aquatic plants; and we perceive an interesting adaptation of structure exhibited by the front parts of the body, the prosternum being advanced beneath the head, and meeting the upper lip, so as completely to shut in the parts of the mouth, and defend them from injury whilst occupied in burrowing.

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* Bibliogr. References to the Parnides.

Leach. On the Parnidea, in Zool. Misc. iii.
Müller, in Illiger Mag. d'Entomol. 1806.
Kunze, in Entom. Fragmente (on the G. Potamophilus).
MacLeay. Annul. Javan.
Klug. Entomol. Brasil. Specimen.
Dufour. Sur les Acanthopodes, ut supra.
Guérin. Icon. Règne Animal.
Germar, in Neu Schrift. der Naturf. Gesellsch. zu Halle, 1811. vol. i. (G. Potamophilus).

In his early works, Latreille, from the resemblance between the antennæ of the typical genus Parnus and that of the Gyrinidæ, formed these two groups into a section, which he termed Otiophori; subsequently, however, he was convinced that the relationship between them was not a direct affinity, and they were accordingly removed to their proper situations.

The European genus Potamophilus (G. Hydera *Latr.*; P. acuminatus, *F. Pz.* vi. 8.), although exhibiting the elongated form of Parnus, differs in having the antennæ 11-jointed, the second joint being large, but not internally produced; these organs are not received into cavities on the underside of the head; moreover, the mouth is not concealed beneath by the dilated anterior margin of the prosternum.

The subfamily *Elmides** (fam. Limniidæ *Stephens*) is distinguished from the preceding by the shorter and more ovate form of the insects of which it is composed (*fig.* 7. 10. Elmis æneus), and by the longer and more regularly formed antennæ (*fig.* 7. 13.), the basal joints being smaller than the following. These curious little insects have been regarded as allied to the Byrrhidæ and Histeridæ, but they are most evidently related to the Parnides.

The species of the genus Elmis are aquatic in their habits, being found adhering on the undersides of stones lying at the bottom of running water. Their motions are very slow; they do not possess the power of swimming, but are provided with very powerful tarsi and ungues (*fig.* 7. 15. hind-leg of Elmis), whereby they are enabled to retain firm hold on the stones in the most boisterous currents; thus offering an admirable instance of adaptive creation in the provision made for those insects destined to live in violent running water,

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* Bibliogr. References to the Elmides.

Latreille, in Hist. Nat. des Fourmis, p. 400.

Müller, in Illiger Magasin, vol. v. Ditto, in Germar's Magasin, vols. ii. and iv.

Dufour, in Ann. Sc. Nat., new series., vol. iii.

Audouin and Brullé. Hist. des Ins. Coleopt. vol. ii.

Contarini. Sopra il Macronychus. Bassano, 1832. (Ann. Soc. Ent. de France, 1833, p. xlv.)

Guérin. Icon. Règne Animal.

And the general works of *Stephens*, *Curtis*, *Germar* (Ins. sp. nov.), *&c.*

where, in fact, ordinary insect motions, swimming or walking, would be completely paralysed. I have found some of the species in such situations in places where the water is constantly a yard deep, and observed that they selected stones with flat rather than uneven surfaces, and especially those covered with a slight coating of vegetable matter. In company with these insects I discovered a great number of small flat larvæ, an outline of one of which I have given at *fig.* 7. 16. upper, 17. underside. The habits of these larvæ, and their slow movements, induce me to believe them to be the Elmis æneus, which I found most plentiful at the same time. I am indebted to W. Raddon, Esq., for a piece of soft whitish mortar-like stone, the under surface of which is very rugose, and burrowed in various directions, in the crevices of which a number of specimens of several species of Elmis were still to be observed; some of the burrows were formed into regular oval chambers, very smooth within, and in some of them I found several rather long and cylindric larvæ, with the segments constricted, and with six rather long legs. These larvæ I should certainly have regarded as those of the Elmis, had I not discovered those above mentioned, which are more analogous to the perfect Elmis, and had I not also in some of the burrows discovered some of these last-described larvæ, each in a fine tube of sand, which induces me to suppose that they must be the larvæ of some Neuropterous insect. I have, however, represented one of these larvæ in *fig.* 7. 18. The under surface of the prosternum, in the perfect insect, is advanced beneath the mouth (*fig.* 7. 14.), as in the Parnides, so as completely to protect the latter at the will of the insect. We are indebted to M. Léon Dufour for a very valuable memoir upon the external and internal anatomy of Macronychus and Elmis, published in the *Annales des Sciences Naturelles*, new series, vol. iii., March, 1835. In this memoir the maxillæ of the subgenus Stenelmis are described, and represented as armed with several strong and acute teeth; but from dissections which I have made of Elmis æneus, I am inclined to think that the maxillæ are unarmed, and that the appearance of teeth is produced by the transverse matting of the hairs at the tip of the maxillæ, as represented in my figure 7. 12.

Messrs. Dufour and Curtis represent the maxillary palpi as 4-jointed; but under the highest-powered lens and in the strongest light I can only detect three joints.

The curious little insect composing the *G. Georyssus* has been

much confused as regards its affinities; Fabricius having called it a Pimelia, and Panzer a Trox. Its tarsi are only 4-jointed, but the structure of the parts of the mouth (see *Guérin, Icon. Insectes,* tab. 20. f. 5.) clearly proves its relationship with the Helophoridæ and Elmides. The anterior tibiæ are slightly dilated and notched. This insect is occasionally found under stones in running streams, but is more frequently observed * in damp earth, with which sometimes the insect is completely coated; but it is evident that this cannot be for concealment (as Kirby and Spence, vol. ii. 258., imagine with respect to some other insects placed by them in this genus, but belonging to Syncalypta *Dillw.*), because it is but rarely that this is the case, and consequently cannot be the natural economy of the animal, only happening when it has by chance found its way into soft muddy ground: this coating of mud, when dry, may be scaled off the insect, all the markings of which may be observed on its inner surface.

The Continental genus *Macronychus* Müller is composed of a single species, M. 4-tuberculatus, a minute aquatic insect, found in the middle and south of Europe. The legs are very long; the antennæ very short, and, according to Latreille and Dufour, 6-jointed, the terminal joint being long and oval, thus approaching, in their irregular construction, the antennæ of some of the smaller Helophoridæ. We are indebted to Messrs. L. Dufour, and Contarini for memoirs upon this interesting insect (figured by Guérin, *Iconogr.* pl. 20. f. 4., and Germar, *Faun. Ins. Eur.* p. 10.). The body appears to be clothed beneath with a fine silken coat; but it is impossible, even with lenses, to discover the hairs of which it must be composed. The males, according to M. Dufour, are entirely apterous, and the females occasionally furnished with fully developed wings; at other times, however, these organs in this sex are very small, and unfit for flight. They are found in running water, appearing to prefer the underside of stones, and especially upon floating wood, burrowing beneath the bark; their movements are very slow, like those of the Elmis. When taken out of the water they do not survive more than two or three hours. M. Dufour was unable to ascertain in what manner respiration is effected in these insects; he, however, as well as M. Contarini, noticed a small bubble of air occcasionally affixed to the extremity of the ab-

* According to M. Wesmael it is always found on the surface of the ground, its body being entirely glabrous, and consequently unable to retain a coating of air when immersed under water.

domen, which the latter considers serves to enable the insect to raise itself to the surface of the water, and descend to the bottom. The eggs are deposited in regular and transverse series upon floating wood, to which they are fixed by a glutinous substance. M. Contarini merely observes of their larva, that they bend themselves into a curved position, and resemble those of the Melolontha; they live under the bark of the floating wood. Like the Elmis, the perfect insects are unable to swim. Dr. Germar has described a second European species, Parnus obscurus *Fab., Germ. Ins. Nov. Sp.* i. 89.; and Sturm has figured an insect from North America as a species, M. variegatus, in his *Catalog.* (Nurmb. 1826); but the regular structure of its 11-jointed antennæ indicates a much nearer affinity with Elmis.

The three following families of Philhydridous Rypophaga are much more intimately allied together than they are to the preceding families. They correspond with Latreille's tribe of Palpicornes, and have the maxillary palpi generally very greatly elongated; the legs are generally formed for swimming, although the motions of the insects are much less active than those of the Dyticidæ. Of these insects the Helophoridæ approach nearest to the preceding families; hence the transition is easy to the large typical Hydrophilidæ, from which, by means of some of the minute species Hydrobius, &c. (especially Cœlostoma orbicularis *Brullé*, which has been always considered as one of the Hydrophilidæ), we arrive at the Sphæridiidæ, which, according to the views of MacLeay and others, are related to the Anistomidæ, although their affinity to the stercorarious Lamellicorns appears equally strong.

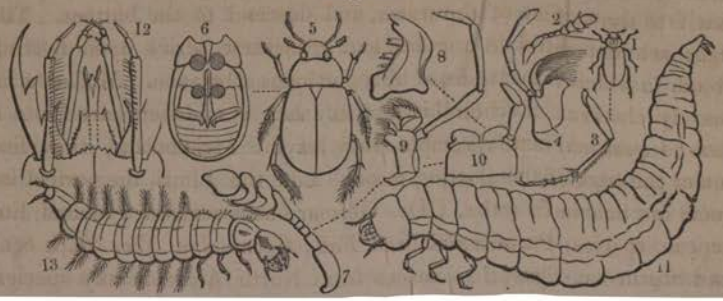
The third family HELOPHORIDÆ * MacLeay (Helophoridea *Leach*) is distinguished by having the body more or less oblong-ovate, and de-

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* BIBLIOGR. REFERENCES TO THE HELOPHORIDÆ.

Leach. On the Helophoridea, Zool. Misc. vol. iii.
Illiger. Kafer Preussens.
Gyllenhall. Ins. Suec.
Weber. Beytrage zur Naturk, vol. ii.
Say, in Journ. Acad. Sc. Philad. vol. iii.

Fig. 8.



pressed, with the surface of the thorax rugose (*fig.* 8. 1. Helophorus aquaticus); the legs slender, and slightly spinose, with filiform tarsi, terminated by two strong claws (*fig.* 8. 3.); the 9-jointed antennæ are terminated by a perfoliated mass (*fig.* 8. 2.), and the mandibles have a single notch near the extremity. This family is of small extent, and the species of which it is composed are of a minute size. The structure of their legs indicates that they creep rather than swim. The under surface of the body is clothed with a thick coat of silky whitish down. They inhabit ponds and ditches, creeping slowly about the roots of aquatic plants, or occasionally coming out of the water, and walking upon the muddy banks, covered with dirt, whence the name of the typical genus; they also often fly about in the hot sunshine. Whilst larvæ, their food consists of animal matter; but they are herbivorous in the perfect state. Some of the species are remarkable for exhibiting a metallic lustre. This family appears to be confined to temperate climates, no species having been hitherto recorded as inhabitants of tropical countries, or, indeed, as belonging to the southern hemisphere.

Mr. Wailes has published an interesting account of the habits of the genus Enicocerus in the *Entomological Magazine* (No. 3. p. 256.), the species of which are found in the crevices of stones in rivulets, just level with or a little above the surface; the larvæ and pupæ are also

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Kugellan, in Schneider's Mag.
Germar. Insect. Species novæ.
Waterhouse, in Entom. Mag. vol. i. (Monograph of Hydræna).
Sturm. Deutchslands Fauna, vol. x.
Erichson. Kafer der Mark Brandenburg
And the general works of *Stephens, Curtis, Fabricius, &c.*

found, in company with the perfect insects, in the autumn. The former are anopluriform, measuring, when full grown, about two and a half lines in length, and half a line in breadth; they are of a uniform black colour, and have the apex of each abdominal segment fringed with very short hairs; their food is probably mucor, and they prefer rough slimy stones. When full grown, they leave the water, and construct, upon the edges of the stone, a small cell, by agglutinating together small particles of mud. These cells are sometimes very numerous, giving the fragment of stone a curious appearance. The pupa is of an orange colour; and the imago, when hatched, gnaws its way through its prison. This account will be observed to correspond with that given above relative to the nests of Elmis.

Relative to the British genera, few particulars will suffice. The large size of the eyes in Hydrochus, the shortness and slenderness of the terminal joint of the maxillary palpi in Octhebius, and the extraordinary elongation of the same organs in Hydræna, are interesting peculiarities. One of the species of the last-named genus is found in brackish water; and Mr. Haworth (*Ent. Trans.* i. p. 87.) states its habitat to be "ad littora salina," near Kingston upon Hull.

The genus Spercheus has been arranged by Leach and others with the Hydrophilidæ. It, however, appears to be the connecting link between the two families, approaching nearest to the Helophoridæ in the structure of the legs, habits, and oral apparatus. The curious structure of the maxillæ (*fig.* 8. 4.) induced Fabricius to place it between the beetles having six and four palpi to the maxillæ.

The fourth family HYDROPHILIDÆ * is distinguished by the ovate or hemispherical and convex form of the body, which is not contractile

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* BIBLIOGR. REFERENCES TO THE HYDROPHILIDÆ.

Leach, in Zool. Misc. vol. iii.
Solier, in Ann. Soc. Ent. de France, 1834.
Audouin and Brullé. Hist. Nat. Ins. Col. vol. v.
Illiger. Kaf. Pr. and Mag. vol. i.
Germar. Ins. Nov. Sp.
Say, in Journ. Acad. Sc. Nat. Philadelphia, vol. iii.
MacLeay. Ann. Jav.

into a ball (*fig.* 8. 5. Hydrocharis caraboides); the thorax is broader than long; the edges of the tibiæ are but slightly spined, but they are terminated by strong spurs; and the tarsi, especially those of the posterior legs, are commonly ciliated, so as to be serviceable in swimming; the basal joint is often minute. The mandibles (*fig.* 8. 8. mandible of H. piceus) are much toothed on their inner margins; the antennæ (*fig.* 8. 7. antennæ of the same) are clavate, and generally 9-jointed *; and the maxillary palpi are often very much longer than the antennæ; the outer lobe of the maxillæ is short, broad, and articulated at the base (*fig.* 8. 9. maxillæ of the same). The mentum is transverse, and the labial palpi short (*fig.* 8. 10.).

The typical insects of this family are amongst the largest of the water-insects; and it is a curious circumstance that the species found in our country exceed in size those from tropical climates; many of the species are, however, very minute. This family is more truly aquatic than the preceding, although the species do not swim with that agility which is exhibited by the Dyticidæ, paddling along by the assistance of their ciliated posterior legs, which they move alternately, whereby the force of their strokes is weakened; when swimming, also, their antennæ are concealed, and their palpi porrected; thus differing in both these respects from the Dyticidæ: on being taken out of the water, however, they extend their antennæ. Their walking

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Erichson. Kafer Brandenburg.
Sturm. Deutchsl. Fauna, vol. ix. and x.
Lyonnet. Posth. Memoirs, vol. i.
Miger, in Annal. du Muséum, vol. xiv.; and Bull. Soc. Philom. vol. ii.
Dufour, in Ann. Sc. Nat. 2d series, vol. iii.
Rösel. Ins. Belust. vol. ii.
Harris. Aurelian; and the general works of *Fabricius, Stephens, Marsham, &c.*

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* Mr. MacLeay considers the antennæ to be in reality 11-jointed; the place of the eighth and tenth joint being indicated by the species intervening between the seventh and eighth, and eighth and ninth, distinct joints. M. Percheron, however (*Genera des Insectes,* pl. 3.), describes the antennæ as 11-jointed; the three last joints being soldered together, and forming what has been regarded as the ninth joint. I can see no transverse trace of the articulations as figured by M. Percheron, although the margin of the ninth joint apparently indicates by its impression the existence of three joints soldered together; but, by carefully examining the antennæ of the various genera of which this and the preceding family are composed, I think it will appear that the loss has taken place among the small central joints at the base of the club.

motions are equally awkward. They generally keep in the water by day, but may occasionally be seen sitting upon plants by the water's edge; they, however, come abroad in the evening, and take wing. On again seeking the water, they cannot dive without difficulty, owing to the dryness of their bodies.

The relationship of these insects with the Dyticidæ has already been noticed; indeed, both families were originally united in the same genus. The anterior tarsi of the males of the typical species are also singularly dilated; but it is the terminal joint only, and not the basal ones, as in the Dyticidæ, which exhibits this peculiarity. The sternum of the thoracic segments is greatly developed; that of the metathorax terminating in a long and acute spine, extending beneath the abdomen (*fig.* 8. 6. Hydrocharis caraboides).

According to M. Dufour, Dutrochet, in his observations on the metamorphoses of the alimentary canal of insects (*Journ. de Physique*, Mars, 1818, in which the digestive organs of Hydrophilus and its larva are purported to be described), has fallen into the error of describing the organs of a Dyticus instead of a Hydrophilus (*Recherch. Anat. sur les Carab.*, &c. p. 37.).

The preparatory states of various species have been observed by different entomologists, especially Rösel, Miger, and Lyonnet. The females of the largest species, Hydrophilus piceus, possess the singular habit of spinning a gummy envelope for their eggs; and in this sex we find the excremental intestine replaced by organs for the secretion of the matter for the formation of such envelope, the anus being also furnished with two spinnerets. The eggs, fifty or sixty in number, are disposed symmetrically, and in an upright position, in their receptacle, which has somewhat the appearance of a small turnip, being nearly an inch broad, and which is attached to some plant until the larvæ are hatched, when it floats about on the surface of the water. The larvæ escape at the lower part of the cocoon, which is closed only by a few threads; one side is furnished with an upright bent horny point, an inch long, which has been supposed to act as a sail, being elevated above the surface of the water; but, from the observations of M. Miger, such cannot be the case, as the cocoons are invariably affixed to plants; he therefore considers it as serviceable in conveying air to the interior; indeed, on detaching a cocoon filled with eggs, the side from which the point arises is immediately submerged by its superior weight. The exterior surface hardens, and becomes impene-

trable to the water, being coated with a gummy secretion, whilst the interior is composed of fine silk of a delicate white colour. This cocoon is also described and figured in the *Mag. of Nat. Hist.* No. 18. In the posthumous memoirs of Lyonnet, this cocoon is stated to be composed of fine twigs of confervæ; but it is evident, from the more precise statements of M. Miger, that silk and a gummy secretion are the materials of which it is composed, the insect making use of the plants only as a support, or perhaps a mould, whilst forming the nest. The larvæ are hatched in about six weeks, or, in warm weather, in twelve or fifteen days, according to M. Miger, and in a few hours make their escape from their common prison. They very quickly attain the length of two thirds of an inch, although the eggs were not half that length. They undergo three moultings; after the first of which they are an inch long, after the second an inch and a half, and three inches after the third (*fig.* 8. 11.). They are of a long and somewhat conical form, of a more fleshy substance than those of the Dyticidæ, with shorter and more slender legs; the body is terminated by two short filiform appendages, which the insect employs in respiration. The head is horny, and of a singular form; its lower surface being very convex, whilst the upper is flattened (whence Frisch fancied that the under side of the body was the back); the mandibles, also, which are robust, and armed with a tooth near the middle of the inner edge, are also elevated; in these respects resembling the structure of the larva of Cicindelæ. The maxillæ are elongated, and compose the basal joint of what, at first sight, appears to be a pair of 5-jointed palpi but which are, in reality, slender maxillæ, with a pair of 4-jointed palpi placed at the tip (*fig.* 8. 12. antennæ and trophi). From the position of the head and jaws, the larva is enabled to seize upon its food, which consists of small aquatic mollusca and other animals inhabiting the water, by suddenly throwing back its head and stretching its mandibles; it is moreover stated by Lyonnet, that it bends its head so far back that it is enabled to employ its back as a table to support its food, which it procures by first breaking the shell. It is compelled frequently to come to the surface to take in a supply of fresh air. Immediately upon seizing its prey, or being taken by the hand, it becomes flaccid, and emits a blackish fœtid fluid from the mouth, accompanied by a slight noise. It is full-grown in July, when it creeps out of the water, and burrows into the adjacent bank, in which it forms an oval cell, by the assistance of an organ situated at

the extremity of the body, and in which it undergoes its metamorphoses. The pupa is thick, and of an oval form, having two rather long curved anal appendages; the sides of the abdomen and front margin of the thorax being beset with rigid hairs, which Lyonnet supposed served to keep the body of the pupa from resting on the damp earth. The pupæ of some species are, however, destitute of these spines. The larva of this insect has been figured by Mouffet (p. 320.), Frisch (vol. i. pt. 2. tab. 6.), Lesser, *Insecto-Theologie* (vol. ii. fig. 12. 16.), Lyonnet, *Post. Mem.* pl. 13., Audouin and Brullé (vol. v. pl. 11.). It assumes the perfect state in about one hundred days from the time when the eggs were hatched, of which period about sixty days were occupied in the larva state.

The larva of Hydrocharis caraboides, figured by Rösel (*Insect. Belust.* vol. ii., *Ins. Aquat.* tab. 4.), and Lyonnet* (*Mém.* pl. xii. fig. 47. 50.), and Harris (*Aurelian*, pl. 26. f. *e–i*), somewhat resembles that of Hydrophilus piceus in its general form (*fig.* 8. 13.), but is considerably smaller; and each of the seven basal segments of the abdomen is furnished on each side with a rather long, slender, and ciliated filament, similar to the larvæ of the Ephemeridæ; the terminal segment also bears at its extremity a pair of slender filiform appendages. The pupa resembles that of the Hydrophilus; its abdomen being terminated by a strong pedunculated lunar-shaped process. The eggs are deposited by the female in a cocoon similar to that of Hydrophilus piceus.

M. Miger (in the *Annales du Muséum d'Histoire Naturelle*, vol. xiv., and in the *Bulletin de la Soc. Philomat.* 1812) has also observed the larvæ of other species, namely, H. luridus, fuscipes, picipes, nanus, lividus, and truncatellus, belonging to the smaller genera, some of which are not furnished with appendages at the extremity of the body; they are unable to swim; neither do they suspend themselves at the surface of the water for respiration, as the preceding species are compelled to do. The female insects of these species swim also with difficulty, carrying their eggs for a long time underneath their abdomen, enclosed in a silken web†, which they at length attach by gluten

* M. Brullé (*Hist. Nat. Col.* vol. v. p. 256.) has erroneously supposed this figure to represent a species of Philhydrus.

† M. V. Audouin has communicated to me the observation that the female Philhydrus bicolor *Solier*, carries its eggs about with it by the assistance of three dilated setose appendages at the extremity of the posterior femora.

to the stems of aquatic plants above the surface; so that the larvæ, when hatched, drop into the water.* The larva of the last-named species (Truncatellus, belonging to the genus Limnebius) is not found in the water; thus clearly indicating the propriety of the establishment of this genus, which Messrs. Solier and Brullé have so much confused, as well as its relationship with some of the Helophoridæ.

In their perfect state these insects are much less voracious than whilst larvæ, the large Hydrophilus piceus chiefly feeding upon aquatic plants, although they also devour with avidity dead larvæ and aquatic mollusca. In like manner, M. Miger kept, for several months, specimens of Hydrocharis caraboides, which he entirely fed upon the latter kind of food. This appears, however, not to be their ordinary food, the structure of the jaws, and more especially the internal anatomy, as observed by M. L. Dufour and by Dr. Gaede (*Nova Acta*, vol. ix. p. 2.), indicating herbivorous habits, the digestive organs differing materially from those of the predacious Dyticidæ, and resembling the Lamellicorns. Clairville has informed us, that notwithstanding its large size, Hydrophilus piceus falls an easy prey to the more voracious, but considerably smaller, Dyticus marginalis. When these insects rise to the surface of the water they protrude their antennæ, which they again fold back when they descend; this motion, according to recent observations, is essential for furnishing a supply of air to the spiracles, a bubble being carried by each beneath the thorax, and brought into contact with the organs of respiration. Vide *Nitzsch*, in *Riels Archiv. fur Physiologie*, xx. p. 440.; *Burmeister* (Shuckard's Engl. edit. p. 392.), and *Audouin and Brullé, Hist. Nat. Ins.*

The smaller species, especially the Hydrobii, may often be observed creeping slowly along, immediately beneath the surface of the water, with the back downwards, a globule of air, shining like quicksilver, being usually carried between the legs, and which is probably retained by the coating of hairs on the under side of the body which repels the water. During the winter they bury themselves in the mud. The species of this family received from tropical climates prove, as Mr.

* Lyonnet, *Posth. Mem.* p. 127. M. De Haan, in his description of the plates, terms the insect, represented by Lyonnet (pl. 12. f. 43—46.), Elaphrus striatus *Fabr.* The former word is evidently a misprint for Elophorus, although the insect certainly does not belong to that genus, but rather to Hydrobius. There is, moreover, no palpicorn insect described by Fabricius under the name of striatus.

MacLeay observes, by their affinity to European insects, how much fewer typical forms there are of aquatic than terrestrial insects. Although few in number, however, the species are very widely distributed, having been received from all quarters of the globe. Dejean, in his new catalogue, gives 101 species, of which seventy-nine are extra-European; whilst Mr. Stephens gives descriptions of about forty British species. Dr. Leach in the *Zoological Miscellany*, and M. Solier in the *Annales de la Société Entomol. de France*, have published distributions of this family, — the various genera now adopted having been chiefly proposed by these two authors.

The species of the British genus Limnebius are of a very small size, none exceeding one eighth of an inch in length. In their habits, and partially in their structure, they approach the Helophoridæ. This genus is one of the best marked in the family, and yet appears to be unknown to recent French authors, who, neglecting Leach's characters, give the aberrant species of Hydrobius as its examples, which, from the differences which they exhibit, I have adopted as distinct groups, as introduced into my Generic Synopsis, p. 10. The genus Hydrophilus comprises the gigantic H. piceus, a species not rare in the neighbourhood of London, and which is an inch and a half long, and many large exotic species, some of which, forming Solier's genus Stethoxus, have the anterior male tarsi simple.

The exotic genus Volvulus *Brullé* consists of a single species (V. inflatus), which I have received from M. Desjardins of the Island of Mauritius, remarkable for its inflated and very compressed form. That of Globaria, as the name implies, is very globose, and contractile into a ball.

The family SPHÆRIDIIDÆ* *Leach*, consists of a small group of species remarkable for their close relationship with some of the Hydro-

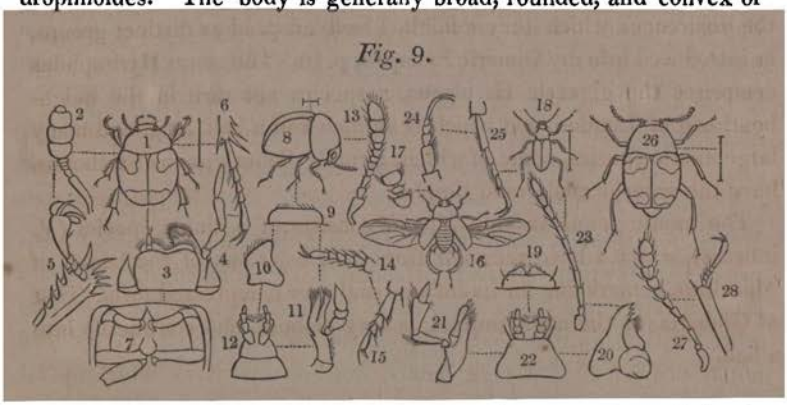
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Leach. Zool. Misc. vol. iii.
Stephens. Ill. vol. ii.
Audouin and Brullé, loc. cit. supra.
Say, in Journ. Acad. Sc. Philadelph. vol. iii.
Erichson. Kafer Brandenburg.
And the general works of *Gyllenhall, Illiger, Germar, Herbst, &c.*

philidæ, arising from the general structure of the body, the form of the antennæ, and more especially of the parts of the mouth, and produced sternum (*fig.* 9. 7.). Their habits are, however, different; since they frequent putrescent vegetable matter which has passed through the bodies of animals, the excrement of horses and cows being their chief abode, over which, when recently ejected, they may be seen hovering in troops, and in which they burrow by the assistance of their spinose tibiæ. Their legs are not formed for swimming, although some of the species (Cercyon hæmorrhoidale, obscurum, anale, &c.) are subaquatic, which, doubtless, induced Fabricius to place them in the genus Hydrophilus, whilst at the same time (thus confirming the relationship of the families) his Sphæridium dytiscoides belongs to the Hydrophilidæ; and his Hydrophilus orbicularis has recently been formed into the genus Cœlostoma by M. Brullé, and placed in the present family. Mr. MacLeay has also named a Javanese species, Sphæridium hydrophiloides. The body is generally broad, rounded, and convex or

Fig. 9.



globose (*fig.* 9. 1. Sphæridium scarabæoides); the tarsi are distinctly 5-jointed, the terminal joint being very large in the anterior pair and dilated, especially in the males (*fig.* 9. 5. anterior, 9. 6. posterior tarsi); the mentum is very large and transverse (*fig.* 9. 3.; *fig.* 9. 4. the maxillæ terminated by a large pilose lobe), and the antennæ are terminated by a large 3-jointed club (*fig.* 9. 2); the labrum is short and transverse, and the maxillary palpi are as long as the antennæ (*fig.* 9. 4.).

The larvæ of none of the species of this family have hitherto been observed. From the very few individuals brought from tropical regions, it may be inferred that their metropolis is within the northern temperate clime. It may, indeed, be questioned whether Nature

in tropical regions requires the presence of such stercorarious insects as these, although it is certain that the smaller Coprides abound in such countries, which probably perform the offices assigned to the Sphæridiidæ in regions where the Coprides are but few in number.

Mr. MacLeay adopts the idea of Fabricius, that this family may possibly include such genera as Phalacrus, Agathidium, &c. That an affinity exists between these insects, cannot be denied; but there are other characters besides the numerical variation in the tarsal joints sufficient to warrant their separation. I have already alluded to the relationship between these insects and the Lamellicornes; and may here add, that Mr. MacLeay, as well as Mr. Kirby, considers that it is from these insects that the transition is effected to that tribe of beetles. It is impossible, however, in a linear series, to exhibit all their combinations of relationship. By Linnæus these insects were arranged with Dermestes, and by De Geer with Hister. The species of Sphæridium are the largest in the family, not, however, exceeding a quarter of an inch in length; they are generally of a shining black colour, with the elytra variegated with large patches of red or dirty yellow.

The family AGATHIDIIDÆ* *Westw.* (Anisotomidæ *Steph.*†) comprises a small group of insects placed by Latreille amongst the Trimerous and Heteromerous Coleoptera, with which, however, they offer no other relationship than that of having the tarsi composed of a reduced number of joints. In their habits, indeed, as well as their general structure, they appear to approach much nearer to some of the aberrant Sphæridiidæ, forming, probably, the connecting link between them and the smaller Necrophaga, to which they are still more nearly allied. That this is one of the groups in which the numerical variation in the

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* BIBLIOGR. REFER. TO THE AGATHIDIIDÆ.

Sturm's Deutchslands Fauna. vol. ii.
The works of *Stephens, Curtis, Illiger, Gyllenhal,* &c.

† The generic name Anisotoma being regarded as a synonyme of Leiodes, ought not to be employed to designate the family.

tarsal joints is apparent, and ought not therefore to be relied upon as affording clear grounds of relationship with other groups, cannot be denied; and accordingly Fabricius placed such of these insects as he was acquainted with between the Sphæridiidæ and Byrrhidæ, whilst Mr. Stephens has placed them at the end of the Philhydrida. I can, however, by no means persuade myself that it would not be more natural to introduce this family amongst the Necrophaga; indeed a comparison of Mr. Curtis's dissections of Leiodes and Catops, or mine of Agathidium and Choleva, will sufficiently prove this. The relationship of some of the genera, inter se, requires investigation, which, from the exceeding minuteness of some of them, is very difficult.

These insects are of a small size, of a rounded or oval form, generally convex, and occasionally contractile into a ball (*fig.* 9. 8. Agathidium atrum); the antennæ are short and clavate, the club varying in the number of its joints (*fig.* 9. 13. antenna of Agathidium). In Leiodes (*fig.* 9. 16. L. cinnamomea, the truffle-beetle ♂), which has the tarsi heteromerous, the club of the antennæ consists of the five terminal joints, the second of which is very small (*fig.* 9. 17. the 7th, 8th, and 9th joints of the antenna of Leiodes). In Agathidium, which is also heteromerous (*fig.* 9. 14. the anterior, and 9. 15. the posterior tarsi), the same occurs, but less strongly marked (*fig.* 9. 13.); and this peculiarity is again found in the Pentamerous Cholevidæ (*fig.* 9. 23.), which indeed Mr. Curtis appears to consider as probably entering the same family. Until, however, these groups have been rigidly investigated, and their structure ascertained, as well as an acquaintance with their larvæ obtained (of which we are still ignorant), it is impossible to decide upon the affinities of these insects. The palpi are generally short and filiform, the maxillary being terminated by an acuminated joint (*fig.* 9. 11. maxilla, *fig.* 9. 12. labium, of Agathidium atrum). The labrum is transverse (*fig.* 9. 9.), and the mandibles nearly triangular, without teeth (*fig.* 9. 10.); the legs short, and sometimes spined. The species are generally found in damp situations, inhabiting putrescent vegetable matter; some of them frequent flowers, and many may be often taken upon the wing in the hot sunshine.

The British genera introduced into this family by Mr. Stephens are described in the Generic Synopsis, with the exception of Tritoma; which, as Latreille long ago observed, belongs to the Erotylidæ, but which Mr. Curtis has formed into a distinct family, named Tritomidæ. The species of Leiodes are amongst the largest British insects in the

family, and the largest of these is not more than a quarter of an inch in length. This is the L. cinnamomea, an insect found in truffles in the early winter months: the posterior femora in the males are large and toothed, and the tibiæ bent. The species of Agathidium and Clambus possess in a remarkable degree the power of counterfeiting death by rolling themselves into a ball, the head being laid upon the breast. The species of Orthoperus and Sericoderus are amongst the most minute Coleopterous insects.

The second stirps of Rypophagous Pentamera is the NECROPHAGA *Latreille;* a group of considerable extent and variable structure, but chiefly distinguished by having the antennæ gradually or suddenly thickened at the tips; the mandibles generally robust and exserted; the maxillæ with the outer lobe large, but not palpiform nor articulated; the maxillary palpi with the basal joint often small; the body often oval or oblong, with the prosternum not anteriorly produced; the elytra sometimes shorter than the abdomen; the legs formed for running, and not contractile. In some of the aberrant species the tarsi differ in the number of their joints.

As the name of the stirps implies, these insects are highly serviceable in removing the decaying remains of animal matter, and such kinds of impurities. Some of the species are, however, employed in feeding upon decaying fungi and other vegetable remains. In some, moreover, are to be traced vestiges of those predaceous habits which characterise the early groups of beetles: thus, as Mr. MacLeay observes, Silpha 4-punctata ascends the oak for the purpose of devouring the caterpillars, of which so many species infest this tree; whilst other Silphidæ attack live terrestrial mollusca, just as we have seen the neighbouring stirps of Philhydrida prey on certain aquatic animals of the same subkingdom. By Linnæus the majority of these insects were ranged in the genera Silpha and Dermestes.

This tribe of beetles is, on the one hand, nearly allied to the Philhydra, with which indeed Dumeril united it under the name of Helocera from the clavate structure of the antennæ; and on the other hand, to the Byrrhidæ and Histeridæ by means of the Dermestidæ; Mr. Kirby introducing the Byrrhidæ amongst the Necrophaga, and making it thus the link between the Necrophaga and the osculant Histeridæ. The relationship of the Silphidæ and the Brachelytra is

even still more distinct, as may be observed in the genera Necrophorus and the larger Staphylinidæ, as well as in the genus Micropeplus, belonging to the Nitidulidæ.

The families into which Latreille divided this group in his "Genera," were — 1. Silphales; 2. Nitidulariæ (divided into the Peltides, Nitidulariæ propriæ, and Ipsides); 3. Scaphidiles; and 4. Dermestini. In his later works, however, he has adopted Dumeril's views, and united them, together with the Histeridæ, Byrrhidæ, and the aberrant Philhydrida, into a group called Clavicornes. In all his works, however, he placed many of the small species far apart in a group, which he termed Xylophaga. Mr. MacLeay divides the stirps into the four following families: —

Normal Group?	
Club of antennæ elongate, perfoliate, 4 or 5-jointed. (Silpha *Linn.*)	Scaphididæ. Silphidæ.
Aberrant Group?	
Club of antennæ short, 2 or 3-jointed. (Dermestes *Linn.*)	Nitidulidæ. Engidæ. Dermestidæ.

These families correspond with those given by Latreille in his late works, with the exception of the Engidæ, in which Mr. MacLeay introduces a great number of insects which Latreille, too much influenced by a desire to retain the tarsal system, had placed among the Tetramerous Xylophaga; although, as I have endeavoured to prove in the *Linnæan Transactions* (vol. xvi.), this is evidently a family, or rather perhaps a series of allied families, characterised by the variation in the structure of the tarsi.

Of the affinities connecting these various families too little is yet known, either of their anatomical characters or the structure of their larvæ, to enable us to speak with precision upon the subject; in like manner, the views of Geoffroy, Linnæus, and other early authors, who never dissected a single insect, cannot be considered as entitled to that weight, with reference to the juxtaposition of these families, which Mr. MacLeay seems disposed to give to them.

The following observations, however, by Mr. Kirby are worthy of attention: "Though the transition from the Brachelytra by Necrophorus to the Necrophaga, especially the Silphidæ, is so evident, yet the road to be taken when we depart from the latter tribe is not equally clear. The Nitidulidæ, indeed, manifest a close affinity to the Silphidæ; but the Engidæ seem separated from both by a rather wide interval, and from them various routes present themselves.

Some would go to the Catheretidæ, others to the Cryptophagidæ, and others to Choleva and the Scaphidiidæ. The former of these tribes seems to me nearer to the Nitidulidæ than the Engidæ, and may be regarded as opening a road from them to the Brachelytra; the Cryptophagidæ appear much further removed, and are leading towards the Dermestidæ." *Faun. Bor. Amer.* p. 107.

The first family SCAPHIDIIDÆ * (Scaphidiles *Latr.*), is a small assemblage of insects of small size (*fig.* 9. 26. Scaphidium 4-maculatum, 9. 18. Choleva angustata), with long and slender legs, 5-jointed tarsi (*fig.* 9. 24. anterior, 9. 25. posterior tarsi of Choleva; 9. 28. anterior tarsi of Scaphidium); the body oval; the head deflexed; the thorax broad behind, generally forming a continuous lateral line with the elytra; the mandibles triangular; the maxillæ terminated by two lobes, the outer of which is sometimes slender; the antennæ of moderate length, the club being 5-jointed (*fig.* 9. 23. antenna of Choleva, with the eighth joint smaller than the two contiguous joints; *fig.* 9. 27. antenna of Scaphidium); the labrum is transverse, bilobed in front (*fig.* 9. 19.); the mandibles (*fig.* 9. 20.) triangular, with two minute teeth near the tip, and a pilose lobe on the inside; the maxillæ with two elongated lobes and subulated palpi (*fig.* 9. 21.); and the mentum conical, truncate; the labium emarginate, and the palpi minute (*fig.* 9. 22.). The insects are very active in their movements, as the length of their legs indicates. They inhabit decaying fungi, rotten bones, &c., and are generally to be found in the perfect state in the spring.

The affinity of the genus Catops with Leiodes, and Choleva with Agathidium, in the preceding family, Agathidiidæ, has been already pointed out; the relationship of Choleva with Scaphidium, although doubted by Mr. Spence, is confirmed by Latreille and Mac Leay. Indeed it is surprising that Mr. Curtis, whose figures of the mouth of Scaphidium and Catops confirm the latter affinity, should

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* BIBLOGR. REFER. TO THE SCAPHIDIIDÆ.

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Erichson. Kafer Brandenburg.

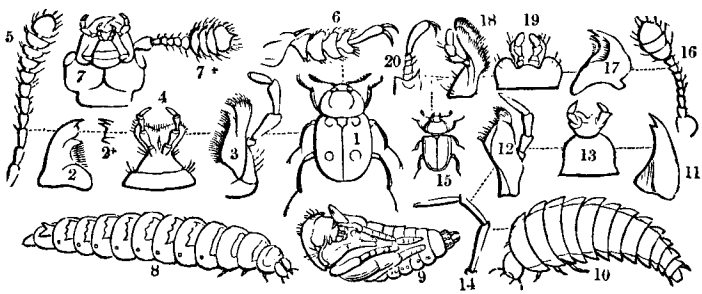
Say, in Journal Acad. Sc. Philadelph. vol. iii.—Mem. Acad. Sc. Stockholm, 1824, p. 149.; and the works of *Stephens, Gyllenhal, Paykull, &c.*

doubt its existence (see fol. 566.), although he admits it in his fol. 379. Mr. Spence has shown the relations of Choleva both with Dermestes and Silpha, and noticed the analogy between it and Mordella, which is much more decided than that existing between Scaphidium and Ripiphorus, noticed by MacLeay; which latter, indeed, is very remote.

The British genera Scaphidium and Scaphisoma are found in agarics, fungi, and under the bark of rotten trees, whilst the other species of the family are more frequent amongst bones, and in the neighbourhood of dunghills. In some species of Catops, the anterior and intermediate tarsi of the males are more or less dilated.

The second family SILPHIDÆ *Leach* (Silphales *Latr.*), is distinguished by the depressed form of the body (*fig.* 10. 1. Silpha

Fig. 10.



4-punctata); the more or less depressed head often posteriorly narrowed into a neck (*fig.* 10. 7. head of Necrophorus beneath);

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* BIBLIOGR. REFER. TO THE SILPHIDÆ.

Leach, in Zool. Misc. vol. ii. and iii.
Herschel, in Illig. Mag. vol. 6.
Hope, in Trans. Zool. Soc. vol. i.
Vigors, in Zool. Jour. vol. i.
Germar. Mag. Entomol. vol. iv.; and Insect. Spec. Nov.
Zetterstedt. Act. Holm. 1824.
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Erichson. Kafer Brandenb.
Charpentier. Horæ Entomologicæ.
Quensel. Dissert. Hist. Nat. Lund. 1790. — Mem. Acad. Sc. Stockholm, 1792.
Say, in Journ. Acad. Scienc. Nat. Philadelphia.
Bulletin Soc. Nat. Mosc. vol. vi.; and the general works above referred to.

the mouth prominent, with strong exserted mandibles (*fig.* 10. 7. and 10. 2.), entire at the tips*; the thorax orbicular, or nearly semicircular, forming a shield to the head; the tarsi are 5-jointed, the fourth joint being but slightly smaller than the preceding (*fig.* 10. 6.); the labrum transverse and emarginate; the palpi filiform, the last joint being slender; the maxillæ (*fig.* 10. 3.) with two lobes, the external one narrowed at the base, and the internal armed with a corneous hook; the mentum transverse, and the labium large and cordate (*fig.* 10. 4.); the antennæ are thickened at the tips (*fig.* 10. 7. * and 10. 5.).

These insects are the most pre-eminently Necrophagous† of the stirps, it being their duty to remove from the surface of the earth animal matter in a dead and putrifying state, which would otherwise become injurious to health; hence they are constantly found in carrion and the carcasses of animals already exposed to the attacks of flies and other insects, whose office it is first to make an inroad upon such substances, which these insects subsequently and more effectually remove. Some species, indeed, frequent trees, where they probably devour Lepidopterous larvæ; others feed upon the inhabitants of small shells found upon the banks of rivers, where they station themselves to lie in wait also for such dead animals as are thrown ashore. Thus the Rev. F. W. Hope informs me, that the Silpha lævigata feeds voraciously upon live snails, digging its strong jaws into the fleshy bodies of the latter, which in vain endeavour to escape. Its larva also exhibits similar propensities; and in like manner Linnæus (*Lachesis Lappon.* vol. i. p. 152.) mentions an insect, evidently one of the flat Silphidæ from the figure, which feeds on fish, and is found running about amongst the scales of fish, as well as in the crevices of the floors of the Lapland huts, and which smells like rue. The Necrophagous species do not, however, strictly confine themselves to dead animal matter, since I have discovered individuals of Necrophorus vespillo devouring a large decaying fungus in which they had taken up their abode. The fetid odour which these insects possess, as well as a black nauseous fluid which they discharge from the mouth, renders them obnoxious. This, however, is not emitted by speci-

* In Silpha 4-punctata one of the mandibles is entire, and the other bifid at the tip (*fig.* 10. 2. and 2*.).

† Mr. Kirby has separated the genus Necrophorus from the Necrophaga, and raised it to a section, Entaphia, of equivalent value with the Adephaga, Brachelytra, &c., a step of which the adoption does not appear to me to be advisable.

mens recently arrived at the perfect state, nor by such as have long fasted; whence, as Olivier supposes, it is from the nature of their food that these insects derive their disgusting scent, which is sometimes so strong as to penetrate every thing in the immediate neighbourhood, and which has been known to be retained for upwards of twenty years without diminution, or without the insect losing anything in weight. The fluid which they emit also serves to mollify the substance upon which they feed, forwarding its decomposition, or being useful as a means of defence. The wonderful instinct of these insects, on the other hand, renders them objects of interest, and of which the proceedings of the Sexton beetles (Necrophorus) detailed by Gleditsch in his *Recreations of Natural History* (*Physical Botan. Œcon. Abhandl.* Halle, 1765) offer an admirable example. These insects are powerful for their size, and run well; their flight is also very strong, the wings being long; their elytra during flight are carried in an upright position, their upper surfaces being almost brought into contact. The insect produces a slight but sharp kind of noise by the friction of its abdomen against the elytra. These insects are not uncommon; and no sooner is any small dead animal, bird, or bit of flesh exposed in the open air, than the Sexton beetles make their appearance; and after rigorously inspecting the object, as it were for the purpose of taking its dimensions, several of them commence operations by creeping beneath the carcass, where, by digging away the earth with their fore-legs beneath and around the animal, it by degrees descends into the ground, although many times larger than the insects engaged in burying it; they then cover it with earth, and sometimes, indeed, bury it nearly a foot deep, the operation occupying only a few hours. In this labour the males assist, and soon after it is accomplished the females deposit their eggs in the carcass. The author above mentioned also records a still stronger instance of instinct exhibited by the same insects; some of which, in order to get possession of a mole fastened to a stick stuck upright in the ground, undermined the stick so that it soon fell to the earth. From an observation of M. Cadet de Vaux, it appears that whilst several individuals of Necrophorus vespillo labour in concert, the larger Necr. germanicus works alone; and according to Latreille the larvæ of the Necrophori entirely consume the buried carcass, leaving neither skin nor bones. Hence it seems that the number of labourers is proportioned to the quantity of food necessary for the support of

their progeny; the great quantity of materials (viz. four frogs, three small birds, two fishes, one mole, two grasshoppers, the entrails of a fish, and two pieces of ox's liver) which Gleditsch's four confined beetles interred in a small piece of ground in fifty days, must, however, have been much more than sufficient for the nourishment of their future progeny, and it was only because these carcasses were placed within their reach that they continued their burying propensities.

The larvæ hatched from the eggs deposited in the buried carcass (and which now serves for their nourishment) are fleshy, and of a long and spindle-shaped form (*fig.* 10. 8. larva of Necr. humator), narrowed at each end, with a scaly head, and a scaly plate upon the upper surface of each segment, diminishing in size upon the terminal segments, and having several strong spines on its surface, which, from the shortness and weakness of the legs, Latreille imagines are employed in pushing the body through the putrifying matter in which the insects are found when full grown. These larvæ are nearly an inch and a half in length. They then form for themselves a cell under ground, with the inner surface smooth and shining, and in which they assume the pupa state (*fig.* 10. 9.), being at first of a whitish colour, and having two strong anal spines whereby they are enabled to turn themselves about in their cell; as they advance to maturity they gradually assume a darker colour. The figures of the larva and pupa of Necrophorus humator are from Rösel's *Insect. Belustig.* vol. iv. pl. 1.

In the Sexton beetles we have seen that as the larva is reared in the midst of a supply of food, it is provided only with weak legs and a cylindric fleshy body; but in the larvæ of the flat species, composing the genera Silpha, Oiceoptoma, &c., which feed upon the same substances as the perfect insect, and are compelled to seek their own food, the legs are much stronger; the body more crustaceous, broad, and flat, thus representing the perfect insect; the posterior lateral angles of each segment are produced into a short but acute point; the anterior or prothoracic segment is the largest, covering the head; the mouth is furnished with a pair of strong jaws, &c.; and the antennæ are 3-jointed; the extremity of the legs is armed with a claw; the anal segment is furnished at the sides with two small slender conical appendages without joints. These larvæ run quickly. They undergo their transformations in the ground. Figures of these last-mentioned kind of larvæ are given by De Geer (*Mem.* vol. iv. tab. 6. Phos-

phuga atrata.* Vol. vii. tab. 44. Oiceoptoma rugosa); Schäffer (*Abhandlung*, vol. iii. pl. 7. Oiceoptoma thoracica, and Phosphuga atrata); and by Brullé, in the *Expedition Scientifique de Morée*, liv. iii. pl. 29. larva of Silpha —? with structural details. Dr. Heer, in his *Observationes Entomologicæ*, has published a detailed description, with figures of the larva of Silpha alpina *Bon.*, which is broadly oval and subconvex, of a shining black colour, with the terminal segment of the body small and armed with two corneous conical spines; the mandibles are robust and horny, with a small tooth near the tip; the maxillary terminal lobe is broad, and denticulated along the inner margin; the eyes are four on each side of the head, arranged in a square. Frisch has figured the transformations of Silpha obscura (Part vi. tab. 5.) I have found many of these larvæ being of a broader or narrower form according to the species; but not having succeeded in rearing them, I have preferred figuring the larva of Oiceoptoma thoracica after Schäffer, but corrected. In some of my larvæ, the body exhibits thirteen distinct segments exclusive of the head; the eleventh segment is transverse, and produced on each side behind into a point; the twelfth is transverse, from the sides of which is emitted the pair of short slender conical processes above mentioned, which are about the length of the following joint, which is probably the exserted portion of the anal apparatus. In some of these larvæ the antennæ (*fig.* 10. 14.) are nearly as long as the prothoracic segment, and nearly as thick as the legs; the lateral anal appendages are also in some of them articulated beyond the middle. The mandibles, maxillæ, and labium of the larva figured above are represented at *figs.* 10. 11. 12. and 13. I have also some larvæ which I apprehend belong to this family, having the head not concealed beneath the prothorax, which is short and transverse, and the head broad; these have the anal appendages much larger than in the preceding.†

M. Laporte has noticed a singular instance of vitality in Silpha carinata in the *Annales de la Soc. Ent. de France*, 1836, (p. xxx. vol. iv.), which lived a long time after its entrails had been entirely consumed by acari, with which it was infested.

The name of the typical genus Silpha was employed by Aristotle

* De Geer states this species became a pupa on the 24th of August, and arrived at the perfect state on the 2d of September.

† Panzer (*Faun. Ins. Germ.* 41. t. 7. c. d.) has represented the larva of one of the Silphidæ under the name of the female of Lampyris noctiluca.

for one of the insects which change their skin; and in one of the comedies of Aristophanes it is said to emit a disagreeable odour. Hence some authors have regarded it as a Blatta. As it is impossible, however, to decide upon the real application of the name, it would be absurd to alter the Linnæan nomenclature.

The species of Necrophorus are the giants of the family, and indeed of the stirps Necrophaga. They have the elytra generally marked by broad irregular orange-coloured bands, and not covering the extremity of the abdomen. The other genera comprise species of black or obscure colours.

The genus Agyrtes *Frolich*, consisting of a single species, A. castaneus (incorrectly introduced into the English Fauna by Dr. Leach), is distinguished by the oval and convex form of the body, the longer and incrassated palpi, and the gradually thickened antennæ; the tibiæ are compressed and spined. A species of the genus Peltidion *St. Farg and Serv.* (Peltis *Fab.*, which Mr. Stephens introduces into the family Silphidæ, but which is nearer allied to Thymalus) has also been improperly introduced into the English lists. The two last noticed genera thus indicate a passage to the following families.

The third family NITIDULIDÆ* *MacLeay* (Nitidulariæ *Latr.*) is nearly allied to the preceding family in the general economy of the insects of which it is composed, many of which are found amongst bones and other animal remains; others, however, frequent various fungi, or reside beneath the bark of trees; whilst some of the smaller

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* BIBLIOGR. REFER. TO THE NITIDULIDÆ.

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Perty. Delect. Anim. Articul. Braz., and Introduction to ditto (G. Rogodon-Psilotus. *Fischer.*)

Dalman. Ephem. Entomol. (G. Acrops.)

Erichson, in Nova. Acta. vol. xvi.

Fischer, in Bullet. Soc. Imp. Nat. de Moscow, 1829 (G. Psilotus); ditto, vol. vi. Trans. Acad. Roy. Naples, vol. i. and the general works of *Fabricius, Olivier, Stephens, Gyllenhall, &c.*

species are found in great profusion in flowers, especially those of the white thorn; these last are frequently of metallic colours. The body is generally broad, oval, and more or less depressed, having the lateral margins strongly elevated (*fig.* 10. 15. Nitidula grisea); the mandibles are elongate, and bifid or notched at the tips (*fig.* 10. 17.); the palpi are filiform, and never thickened at the extremity (*fig.* 10. 18. maxilla, and 10. 19. labium with their palpi); the club of the antennæ is abrupt, short, and composed of two or three joints (*fig.* 10. 16.), the last of which is sometimes (as in Strongylus) terminated by a kind of wart; the thorax is transverse, and emarginate in front to receive the head; the anterior tarsi (*fig.* 10. 20.) have the three basal joints in general dilated and occasionally bifid; and the elytra in some of the genera are truncate, and do not entirely cover the abdomen. The greater portion of these insects are inhabitants of our own country: they are of small size, none exceeding a quarter of an inch in length, and of obscure colours; those, however, which are found under bark exhibit various markings of pale colour.

The larvæ of these insects, so far as known, considerably resemble those of the typical Silphidæ. In the first volume of the *Linnæan Transactions*, Mr. William Curtis published an account of Nitidula grisea (recently introduced into the *Arboretum Britannicum* of Mr. Loudon, p. 1479.), which inhabits willow trees, feeding upon the moist and fermenting sawdust-like substance occasioned by the ravages of the Rhynchænus lapathi. The larvæ are somewhat depressed, of a dirty white colour, with six scaly legs; and the extremity of the body is also furnished with four small horny conical appendages curved upwards; each segment is also beset with several short stiff hairs, and the lateral margins of the abdominal segments are furnished with a small fleshy somewhat conical protuberance; the under side of the extremity of the body is also provided with an appendage which is employed as an additional leg. It is in similar situations that I have met with this larva which I have represented in *fig.* 11. 1.; Mr. Curtis's figure not giving a correct idea of the form of the head. The pupæ are to be found beneath the surface of the ground amongst the moist earth and sawdust, as well as the perfect insects, which are also to be observed in the crevices of the bark.

M. Bouché (*Naturg. der Insekt.* p. 188.) has described the larva of Nitidula obsoleta as being of a linear and flattened form, with a round head; short 4-jointed antennæ; and with a pair of diverging

Fig. 11.



nearly straight horns on the terminal segment. The same author has also described and figured the larva of Strongylus (Nitidula) ferruginea (*fig.* 11. 2.), which materially differs from those above described, being cylindrical, wrinkled, clothed with short hairs, the legs moderately long, and the abdomen obtuse at the extremity. It is found in autumn and winter in Lycoperdon bovista (*fig.* 11. 3. anterior tarsus of its imago).

The genus Byturus (*fig.* 11. 5. B. tomentosus) in its habit of frequenting flowers, and in the bilobed form of the third and minute size of the fourth joints of the tarsus, approaches the Nitidulidæ, from which, however, it recedes in several important particulars. It is placed in the family Engidæ by Stephens. Bouché describes its larva as cylindrical, depressed in front; antennæ conical, 4-jointed; and the abdomen as terminated above by two brown curved points, and beneath with a cylindrical tubercle employed as a proleg. It feeds in June and July on the fruit of the raspberry, and is called in German "himbeermade," or the raspberry maggot. Kirby and Spence also state (*Intro.* i. 197.) that the perfect insect eats through the footstalk of the blossom of the same plant, so as sometimes to prove fatal to an entire crop. Dr. Hammerschmidt (*De Insectis Agriculturæ damnosis, &c.* Vienna, 1832, tab. 3.) has figured this insect with its larva feeding on the raspberry. The latter is represented in my *fig.* 11. 4., corresponding with Bouché's description. The pupa is very pilose.

The typical species of this family are very nearly allied to the genus Ips in the following group; indeed the structure of the mouth is very similar, whence by some authors the latter genus has been introduced into the present family. The general appearance of the insects, however, and the decided affinity of Ips to Cerylon, Ne-

mosoma, &c., induces me, in accordance with the views which I have more fully detailed in the sixteenth volume of the *Linnæan Transactions*, to keep the two groups distinct.

The fourth family ENGIDÆ *MacLeay* is an extensive group of insects, of very difficult location in a natural system, differing from the Nitidulidæ in the more elongate form of the body and simple tarsi, and from the Dermestidæ in the more developed structure of the mandibles, and the generally more glabrous body. So diversified, however, is the structure of the various minor groups introduced by MacLeay and Stephens into the family, that it is next to impossible to lay down any general character. Latreille, as before observed, from giving too great a weight to the tarsal system, distributed these insects amongst his Pentamerous, Heteromerous, and Tetramerous sections; the greater portion, however, constituted his tribe of Xylophaga introduced between the Rhyncophora and Longicornes; Scolytus, Apate, &c., being considered as the links uniting the group with the former, and Trogosita and Cucujus with the latter. It is true, indeed, that in many of these insects there are but four distinct tarsal joints; but at the same time it is equally evident that the great divisions typified by Curculio and Cerambyx have so striking an uniformity in the structure of their tarsi and the apod character of the larvæ, that the introduction of such heterogeneous groups as Latreille's Xylophaga between them cannot be considered otherwise than as most unnatural. We know, however, too little of these groups, most of the species of which are of minute size, and have been much neglected, to speak with precision upon their various relations. In the *Règne Animal* we find these insects forming the following tribes: — Engidites amongst the Pentamera; the typical genera Paussus, Bostrichus, Monotoma, Mycetophagus, and Trogosita, amongst the Xylophaga, and the tribe of Platysoma (Cucujus). Mr. MacLeay also considers Triplax and Languria to enter into the family Engidæ, which latter genus would also necessitate the introduction of the Erotylidæ, the real pentamerous structure of the tarsi of which is clearly proved by an examination of such genera as Ips, Engis, Triplax, and Ero-

tylus.* If, however, the Erotylidæ be thus introduced, the Endomychidæ appear to me to be too closely allied to them to be rejected. Mr. MacLeay, indeed, suggests that it is by the Erotylidæ that the opposite points of the circle of Coleoptera meet. One thing is, however, certain as regards these insects; namely, that although the tarsi in the Coleoptera generally offer a decided constancy of character in exclusive groups, they here exhibit numberless variations, even in the sexes of the same species (*fig.* 12. 9. 10. and 17. 18.). From these considerations, and from the very variable structure of the insects introduced into the family Engidæ, especially in their larva state, it will be evident that the family requires much subdivision; a step which ought cautiously to be taken. With a view to effecting this, I have dissected many of the genera, and have been fortunate in procuring a considerable number of their larvæ; but I would not wish the groups subsequently given to be regarded otherwise than as provisional.

We have already seen that some of the genera, such as Ips and its allies, are nearly allied to the Nitidulidæ. The general habits of these and other approximating genera indicate a group, of which, both as regards the larvæ and form of the trophi, I have regarded Trogosita to be the type. In the majority of these the maxillæ are terminated by a large single lobe (*fig.* 11. 17. and 12. 4.), and the larvæ are more or less fleshy, with two short curved hooks at the extremity of the body. The affinity of these insects with the Cucujidæ, and of the latter with the Paussidæ, I have endeavoured to prove in the *Zool. Journ.* and *Linn. Trans.* There still, however, remain a number of genera which I would provisionally arrange with Mycetophagus, although I cannot but admit that they have but little real relation therewith. The Erotylidæ, notwithstanding their evident relation with Engis and Dacne, I have provisionally removed from the family.

As regards the habits of these groups, it may be generally observed that they are found under the bark of trees, or in fungi, chiefly feeding upon decaying vegetable matter; never attacking either living or dead animal matter.

* See the observations of M. Lacordaire, upon the strong affinity existing between Engis and Erotylus, both in form and habits. In the larva state, the former reside in Boleti, &c., and it is also upon or in the neighbourhood of such productions that the perfect insects are found in South America. (*Ann. Soc. Ent. France*, vol. i. p. 359.)

The first subfamily, which I would name TROGOSITIDES*, comprises not only the Trogositariæ of Latreille (which Stephens and Curtis, following Latreille, remove from its legitimate affinities, and place between the Curculionidæ and Cerambycidæ), but also many genera placed in the family Engidæ, which latter name I have not retained for the subfamily, because, from the structure of the maxillæ of Engis (*fig.* 11. 8.), it does not appear to be so typical a form as Trogosita (*fig.* 11. 17.). These insects have the body more or less oblong, and generally polished (*fig.* 11. 6. Engis rufifrons, 11. 14. Trogosita mauritanica); the antennæ short, clavate, and composed of ten or eleven joints (*fig.* 11. 10.); the maxillary palpi scarcely longer than the produced lobe or lobes of the maxillæ (*fig.* 11. 8. and 17.); the labium is advanced in front of the mentum (*fig.* 11. 9. and 18.); the labrum is transverse (*fig.* 11. 15.), and the mandibles generally bifid at the tips (*fig.* 11. 7. and 11. 16.); the tarsi are simple, and often 4-jointed; in some, however, there are five joints, in which case one of them is of a minute size (*fig.* 11. 11. anterior, 11. 12. posterior tarsi of Engis; 11. 19. anterior, 11. 20. posterior tarsi of Trogosita). In addition to the affinities above noticed, the relations of this group with other insects is not less striking. Thus in the subcortical habits and form, as well as in the structure of the larvæ of such genera as Cerylon and Rhyzophagus, an approach is made towards the Heteromerous genera Hypophlæus, &c.; whilst the grain-feeding habits of Trogosita are very similar to those of Uloma, &c. as well as to some of the smaller Cucujidæ.†

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* BIBLIOGR. REFER. TO THE TROGOSITIDES.

MacLeay. Annulosa Javanica.

Gory and Percheron. Genera des Insectes.

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Hellwig and Kugellan, in Schneider's Mag.

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Boerner. Oekon. Nachr. der Gesellsch. in Schlesien, b. iv. s. 73.

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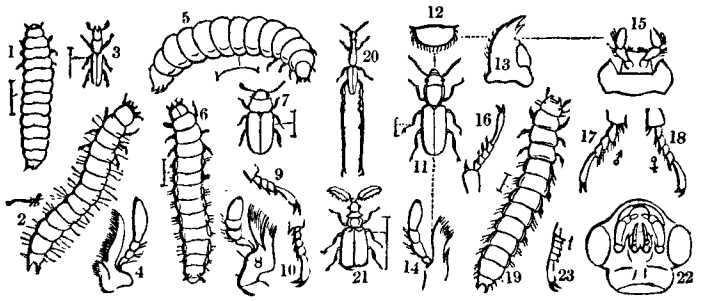
Sturm. Deutchslands Fauna Insecten.

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† Gyllenhal, MacLeay, and Kirby regard the Trogositidæ as connected with the Lucanidæ; whilst Latreille is considered by the last-named author as correct in connecting the Xylophaga with the Capricornes by means of the Platysoma *Latr.*

Some of the species subsist upon the sap exuding from wounds in various trees. It is in such situations in the New Forest that the rare Synchita (Cicones *Curt.*) variegata *Hellw.* has been taken by Messrs. Hope and Rudd. I have found the larvæ of Rhyzophagus (Cerylon) bipustulatus (*fig.* 12. 1.) in company with the perfect insect under the bark of trees in Kensington Gardens. They are long, narrow, and slightly convex, with six short legs; the antennæ and trophi also short, and the terminal segment is furnished with a pair of small diverging spines. Mr. Curtis forms this genus into a family named Cerylonidæ, considered to be allied to the Heteromerous Hypophlæus; but its entire habit, structure of the mouth, and economy are too near to the other insects amongst which it is here introduced to allow the variations in the tarsi, which are here also Heteromerous, to prevail.

Fig. 12.



The rare Nemosoma elongatum (*fig.* 12. 3.—*fig.* 12. 4. its maxilla) is found under the bark of old elm rails, frequenting the firmly fixed bark, and in company with great numbers of Hylesinus varius, which appear to me to make the labyrinth-like passages which have been attributed to the Nemosoma. Mr. T. Ingall discovered this insect in profusion near Sydenham, and was so kind as to conduct me to the spot, where I found many specimens. During the day they were sluggish; but I observed that their motions by candlelight were much more active, reminding me of a small Lathrobium: when they approached their companions they opened their strong jaws very widely, and attempted to bite each other. In company with these I also discovered the larvæ (*fig.* 12. 2.), which are very long, narrow, and subdepressed, having a very quick motion when excited, and when touched throwing themselves into various attitudes like a small Sta-

phylinus. Unless excited or in fear their movements are slow, like the imago. The jaws are much exserted, and frequently opened whilst creeping about. The head is flat, and in walking it is constantly in motion from side to side, or upwards and downwards. They draw the abdomen after them by the contraction of the rings, affixing themselves in their advanced position by means of an anal proleg; and in running backwards, which they easily do, they fasten themselves by this proleg, and then pull the rest of the body towards it; when fastening themselves by the legs again they extend the body backwards, again affixing themselves by the anal proleg. The last segment of the body is furnished above with two small spines.

The larva (*fig.* 11. 21.) of Trogosita caraboides (*fig.* 11. 14.) is long, narrow, especially towards the head, white, fleshy, and with long scattered hairs; the head small and piceous, as well as two spots on each of the thoracic segments; the last abdominal segment has two rather strong conical spines. This larva is termed by the French Cadelle, and is extremely injurious to housed grain, upon which it feeds. There is a memoir by Mr. Kirkupp on this insect in *Entomological Trans.* pt. 3.; and another by M. Dorthes upon its ravages in granaries, and an account of its transformations, noticed in Latreille's *Hist. Generale*, vol. xi. Dr. Hammerschmidt has also figured this insect in its different states in his memoir *De Insectis Agriculturæ damnosis*, Vienna, 4to. 1832, pl. 2.

Mr. MacLeay observes of the larva of Tribolium (Colydium *Herbst.*) castaneum, that it scarcely differs from that of Dermestes, except in being less hirsute (*Ann. Javanica*, No. 92.). I am indebted to M. V. Audouin for a figure and description of the larva of Colydium sulcatum (*fig.* 12. 5.), which resides beneath the bark of the elm. The larva is long, subdepressed, slightly curved; with three pairs of short thoracic legs, and a pair of short recurved horny sharp points upon the terminal segment of the body. Dr. Ratzeburg has also figured this insect in its different states in his *Forst-Insecten*, representing the larva as creeping in a horizontal position, and not with the body curved; the pupa is very much elongated, with two short obtuse points at the extremity of the body.

Engis rufifrons (*fig.* 11. 6.) inhabits Boleti. I am indebted to Dr. Dickson for a specimen of Boletus polymorphus, in which a great number of this insect had been reared, and in which I also discovered the larvæ (*fig.* 11. 13.) in great profusion, which are narrow, somewhat

cylindric and scaly; with six short legs, and two strong short points at the extremity of the body, which is sparingly clothed with scattered hairs. In this genus we do not find the subcortical habits of the subfamily; and the lobe of the maxillæ, which in the true subcortical species is elongated and ciliated, for lapping up sap, is here shorter, broader, and the internal lobe developed (*fig.* 11. 8.). This is also the case in Cryptophagus (*fig.* 12. 7. C. cellaris, 12. 8. its maxillæ), which feed in puff balls, in one of which I found a great number of the larvæ (*fig.* 12. 6.) in the month of September. They are long, narrow, subconvex, somewhat fleshy, with the sides of the segments with small fleshy tubercles, six short legs, and two distant short points on the last segment of the body. The majority died without undergoing transformation; but I afterwards found the perfect insect in the crevices of the puff ball in the box in which the larvæ had been placed. The larva also agrees with Bouché's description of the larva of Cryptophagus lycoperdi (*Naturg.* p. 91.). The posterior tarsi vary in the sexes (*fig.* 12. 9. 10.); the individuals with 4-jointed tarsi have been supposed to be females, but from analogy with Cucujus (*fig.* 12. 17. 18.) I apprehend they are the males. M. Macquart (*Ann. Sc. Nat.* vol. xxiii. p. 94.) has described a new species of Cryptophagus (C. bettæ), which does much damage in fields of beet-root by devouring the plants as soon as they appear above ground. A minute insect evidently belonging to this group, remarkable for its apparent blindness and for its terrestrial habits, has recently been described by M. Wesmael under the name of Anommatus terricola (vide *Ent. Trans.* vol. ii. p. xii.). It is, I believe, a British insect.

The genus Antherophagus, from its decided affinity with Cryptophagus, will also most naturally enter the same group.

The second subfamily CUCUJIDES * (Cucujipes *Latr.*) is of small extent, evidently very closely allied to Trogosita, which genus, indeed,

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* BIBLIOGR. REFER. TO THE CUCUJIDES.

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Westwood, in Zool. Journ. 18.
Guérin and Percheron. Genera des Ins.
Perty. Del. Anim., art. Brasiliæ.
Guérin. Mag. de Zoologie and Iconogr. R. An.— Ditto, Mag. de Zool. pl. 34. (Calodromus), pl. 24. (Hypocephalus).

has been placed by Gyllenhal and Stephens in this subfamily, which has been removed to a wide distance from its legitimate affinities. The body is oblong and depressed (*fig.* 12. 11. C. piceus); the head large and porrected, with a rounded labrum (*fig.* 12. 12.), powerful exserted jaws (*fig.* 12. 13.); the outer lobe of the maxillæ is broad, and the inner lobe small, and often reduced to a mere hook (*fig.* 12. 14.); the palpi are short, filiform, or but very slightly thickened at the tips; the labrum produced, and often bilobed (*fig.* 12. 15.); the antennæ are generally longer than the head and thorax, and of equal thickness throughout, or moniliform; in some species, however, they are clavate; the thorax is generally subquadrate; the joints of the tarsi are simple, entire, and generally five in number, the basal joint being often very minute, and occasionally obsolete in the posterior legs, so as to cause the insect to appear heteromerous (*fig.* 12. 17. posterior tarsi of the male, and 12. 18. ditto of the female C. Freyersii *Van H.*). These insects are of small size, and are chiefly found beneath the bark of trees or in decaying wood. One species, C. Spartii, occurs at Coombe Wood, under the bark of old stumps of white broom; and C. C. Babington, Esq., F.L.S., informs me that he meets with another species (C. testaceus *Steph.*) in plenty in a granary at Cambridge. I also discovered many specimens of the same species creeping up the walls of a granary at Hamburgh.*

I have discovered the larva of Cucujus Spartii in the same situations as the perfect insect. It is long, narrow, and subdepressed (*fig.* 12. 19.), of a fleshy consistence and white colour, except the head and terminal joint of the body, which are of a yellowish-brown; with short 4-jointed antennæ and six short legs; the thoracic seg-

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Griffith. An. Kingd. for figure of Cucujus Freyersii, *Van Heyden*, in Isis de Frankfort (C. mandibularis *Guérin*, C. Dejeanii *Gray*, Palæstes bicolor *Perty*).
Dalman, in Schon. Syn. Ins. vol. iii. App. (Passandra). — Ditto, Analecta Entomol. (Rhysodes).
Newman, in Entom. Mag. No. 24.
Gistl, in Isis, 1829, p. 1131.
And the works of *Curtis*, *Stephens*, *Gyllenhal*, &c.

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* In this respect, as well as in the similarity of the structure of the larvæ, there is the strongest resemblance between Trogosita and Cucujus.

ments are semitransparent, so as to show the motion of the base of the legs from above. When disturbed, it slightly elevates the extremity of the body, which is terminated by two short but rigid incurved hooks.

In a memoir upon the affinities of the genus Clinidium of Kirby, inserted in the *Zool. Journ.*, I have reviewed the characters of, and illustrated with numerous figures the genera introduced into, this family, which may be considered as allied, not only to the Trogositides, but also to the Paussidæ and Cerambycidæ.

The British genera evidently require subdivision. There are several remarkable exotic genera, which appear most naturally to be allied to the present group of insects, although it must be admitted that their characters are so anomalous that it is very difficult to trace their affinities. Such are the genera Passandra *Dalm.* and Catogenus, *Westw. Zool. Journ.* (Isonotus *Perty*? Cucujus rufus *Fabr.*), in which the underside of the head is produced on each side, so as completely to enclose the sides of the mouth. The genera Clinidium and Rhysodes also appear to be most nearly allied to these insects, although they are in some degree allied both to Parandra and Brentus. Calodromus, also, a most anomalous genus from Malabar (*fig.* 12. 20. C. Mellii *Guér.*), having the posterior tibiæ very minute, and the basal joint of the posterior tarsi as long as the entire body, also appears to be most naturally allied to the present group; as does also the Brazilian genus Hypocephalus*, which has so strong an analogy with Gryllotalpa. Both these curious insects are figured in Guérin's *Magasin de Zoologie.*

The fifth family PAUSSIDÆ†, although of very small extent, comprises some of the most remarkable forms amongst the Coleoptera. The

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* Dr. Gistl has recently published another figure and description of this extraordinary insect, under the name of Mesoclastus paradoxus (*Faunus*, No. 2.).

† BIBLIOGR. REFER. TO THE PAUSSIDÆ.

Linnæus. Bigæ Insect. Upsal. 1775.
Afzelius, in Trans. Linn. Soc. vol. iv.
Donovan. Insects of India and New Holland.
Schönherr. Synonymia Insect. vol. i. part 3.
Thunberg, in Act. Holm. 1781.

species are of small size, varying from a quarter to half an inch in length. The body is of a firm consistence, and of an oblong, quadrate, subdepressed form (*fig.* 12. 21. Paussus Klugii *Westw.*), narrowed in front; the head small, and generally narrowed behind into a neck; the antennæ, which are the most singular parts of these insects, are of a very large size, composed of two or more (but never attaining eleven) joints, of a very irregular construction; the palpi are often very much developed, and unequal (*fig.* 12. 22. the head, seen from beneath); the elytra are broader than the rest of the body; the legs short, strong, and compressed; the tarsi short and entire, generally 5-jointed, the basal joint being often very minute (*fig.* 12. 23.)

These extraordinary insects appear exclusively to inhabit the Old World; the tropical and southern parts of Africa and Asia and New Holland being the only countries from which they have been received. They appear, indeed, to be of extreme rarity. But little is known of their habits; they are stated by Afzelius to frequent newly-built houses, in the wood of which they most probably are reared. M. Westermann also states (in his account of East Indian and Cape Insects, published in Silbermann's *Revue Entomol.* No. 3.) that he discovered eight species of this group, all of which were taken accidentally in houses about wood, flying by night, whence he conceives them to be nocturnal and xylophagous. The first-named author, who found Paussus sphærocerus at Sierra Leone, also mentions that it appeared to him that the large globose portion of the antennæ of this species was luminous, a circumstance which I have elsewhere given my reasons for considering inaccurate. According to information given by M. Payen (who resided for some time in the Moluccas and Isles of Sunda) to M. Lacordaire, the species of Paussus possess a crepitating power, similar to that of the Brachinidæ (*Lacord. Introd.* ii. p. 57.). Another still more curious circumstance concerning these insects has been recently observed by M. Verreaux; namely, that some of the species, at least, reside in ants' nests. These insects were arranged by Latreille amongst the Xylophaga; but

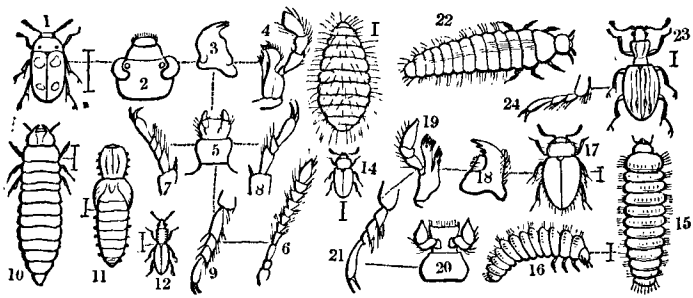
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Chevrolat, in Guérin's Mag. Zool.
Guérin. Iconogr. R. An. — Ditto, in Revue Zoologique, 1838.
Westwood, in Trans. Linn. Soc. vol. xvi.; and in Trans. Ent. Soc. vol. ii.
Kollar, in Annal. Wien. Mus. Naturg. vol. i.

in my monograph upon this family, I have endeavoured to show the propriety of their removal to the Necrophagous stirps. In the genera Paussus, Hylotorus, and Platyrhopalus *W.*, the antennæ appear to be only 2-jointed, the terminal joint being very large and irregular, varying very considerably in its shape. In Pentaplatarthrus *W.* the antennæ are very large, the five terminal joints being very flat. In Lebioderus *W.*, the same number of joints also apparently exists, each joint of the club being posteriorly spined; and in Cerapterus the antennæ are also very large, and 10-jointed. The genus Trochoideus *W.* I have ascertained, by the dissection of a second species from Madagascar, to belong to the Erotylidæ.

The sixth family MYCETOPHAGIDÆ*, as a provisional group, may be considered as comprising the residue of the family Engidæ *Stephens*, in which the species are rather fungivorous than subcortical; the

Fig. 13.



body seldom being glabrous (*fig.* 13. 1. Mycetophagus 4-pustulatus), the maxillæ always bilobed, the palpi being larger than the lobes

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* BIBLIOGR. REFER. TO THE MYCELOPHAGIDÆ.

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Chevrolat, in Silb. Revue Entomol. No. 17. (Myrmichixenus).
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Brongniart. Bullet. Soc. Philomat. 4 ann. (Dasycerus); and the general works of *Herbst, Paykull, Gyllenhal, Stephens*, &c.

(*fig.* 13. 4. —*fig.* 13. 5. labium); the mandibles short, not exserted, bifid at the tips (*fig.* 13. 3.); the upper lip transverse (*fig.* 13. 2. head of M. 4-pustulatus, *fig.* 13. 6. antennæ of ditto); the tarsi often possessing fewer than five joints (*fig.* 13. 7. ♂ ?, 13. 8. ♀ ? anterior tarsus, 13. 9. posterior tarsus of Mycetophagus, *fig.* 13. 21. tarsus (all similar) of Mycetæa hirta, —*fig.* 13. 24. tarsus (all similar) of Latridius); the larvæ, as far as I am acquainted with them, never have the extremity of the body armed with the pair of hooks or spines observed in the Trogositideous larvæ. Mr. Stephens has well observed, in speaking of his family Engidæ, that the more elongate, sometimes linear, form of the body, combined with the generally simple joints of the tarsi and less abruptly clavate antennæ, distinguish them from the Nitidulidæ; adding, however, that the family evidently requires subdivision; and, indeed, it seems necessary to introduce still further minor divisions amongst the genera given in my *Synopsis*, but which a more perfect knowledge of their characters and structure, both in the larva and perfect states, would alone warrant. Moreover, the small size of these insects, some of them being amongst the most minute Coleoptera, and the consequent scarcity of extra-European species hitherto described, materially increase the difficulties connected with these groups. The typical genus appears to be Mycetophagus (*fig.* 13. 1.), with which Latreille unites Biphyllus, Meryx, Dasycerus, Latridius (*fig.* 13. 23.), and Silvanus (*fig.* 13. 12.) The Heteromerous genus Tetratoma is also much more nearly allied to Mycetophagus than it is to Diaperis, near which last it is placed by Latreille, as may be seen by consulting Mr. Curtis's figures of these genera.

The species chiefly frequent fungi and rotten wood; some of them devour corks, and occasionally produce much damage in wine cellars, by consuming the corks of wine bottles. This is the case with Mycetæa hirta, and some of the species of Latridius.

The species of Mycetophagus are found in fungi and the rotten stumps of trees; their elytra are generally marked with yellow or pale-coloured spots. Mr. G. R. Waterhouse informs me that the larva of M. 4-pustulatus resembles that of Megatoma undatum.

The larva of Silvanus dentatus, as well as the perfect insect, may often be found dead in sugar, and observed floating in tea or coffee; hence it is not, probably, an inhabitant of this country. This larva is elongated, depressed, and glabrous, with the central abdominal seg-

ments rather broader; the terminal segment is entire, and the legs are short. A smaller species of the same genus (Dermestes Surinamensis *Linn.*, *fig.* 13. 12.) is sometimes found in similar situations. It is, however, occasionally discovered in various distant parts of the country. I possess specimens from Yorkshire, Epping Forest, and Scotland, taken under the bark of trees. Mr. Ingpen has also furnished me with a series of specimens of the insect in its various states, found in bran in Scotland. The larva (*fig.* 13. 10.) resembles that of S. dentatus, but is smaller; it is of a whitish colour, as is also the pupa (*fig.* 13. 11.), which has the head bent upon the breast, and the margins of the abdomen, as well as the thorax, armed with short thick points.

M. Chevrolat has published an account of the small Continental species Sphindus Gyllenhalii *Dej.* (*fig.* 13. 14.), found in the interior of minute Lycoperdons. The mandibles are entire, the antennæ 10-jointed, and the tarsi heteromerous: hence M. Chevrolat considers that it should be placed next to Tetratoma. A figure of the larva (*fig.* 13. 13.) is given, drawn from a dried specimen; it is thick, or oblong-ovate in form, with several blackish points, and clothed with long, white, delicate, and distant hairs; the extremity of the body is entire, and rounded.

In November 1832, I discovered a great number of the Mycetæa hirta (*fig.* 13. 17.— 13. 18. mandible, 13. 19. maxilla, 13. 20. labium, 13. 21. posterior tarsus) in a large fungus, growing upon wood, in a damp situation. These insects varied in their colours, according to the length of time since their exclusion from the pupa, some being almost white; at the same time I found a great number of their larvæ (*fig.* 13. 15., 13 16.), which are fleshy, and of a whitish colour, with a dusky line down the back, caused by the dorsal vessel. They are of a moderate length, and somewhat convex, the segments being divided by deep incisions; the head is small; and the six legs are short, so that they cannot be observed from above when the larvæ walk; the last segment of the body is entire and rounded, and is furnished beneath with a small anal proleg. They are entirely clothed with numerous thick and clavate hairs; when touched, they bend the head and tail towards the breast. They prefer the dried part of the fungus, of which the fresh and damp parts are first attacked by myriads of minute lead-coloured shining Poduræ. I did not find any pupæ of this beetle. Mr. Curtis (*Brit. Ent.* fol. 502.) and Mr. Saunders (*Trans. Ent. Soc.*

Lond. i. p. lv.) have published some observations upon the supposed attacks of this insect upon the corks of wine-bottles in cellars.

The transformations of Latridius * lardarius have been described and figured by De Geer (*Mémoires*, vol. v. pl. 2. f. 25—31.), who found the larvæ in a dried pig's bladder; they are white, with a dark line down the back (*fig.* 13. 22.), having the body moderately long, narrowed towards the posterior part, the articulations being deeply incised, and covered with moderately long hairs; the head is small, and the terminal segment is small, entire, rounded, and provided beneath with an anal proleg. These larvæ underwent their changes in a glass bottle, against the sides of which they attached themselves by the extremity of the body, where they became small pupæ, clothed with rather long hairs, having a small knob at the extremity of each.

Kyber has also given a long account of the transformations of Latridius porcatus in the second volume of Germar's *Magazin der Entomologie*, in which the larva is represented with a much larger head, and the segments of the body more contracted than in De Geer's figure. These larvæ fed upon the mucor found upon vegetable and animal substances, and were particularly fond of the radish (Raphanus sativus); they were also found upon the corks of bottles, which they probably also fed upon. The larvæ lived from March to the middle of May, at which time they changed to pupæ, fastening themselves to the sides of the glass, in which they were confined, by their tails, with their heads uppermost, in which state they remained fourteen days.

The seventh family DERMESTIDÆ † *Leach*, having for its types the chief species of the Linnæan genus Dermestes (*fig.* 14. 1. Derm. lar-

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* My figure 13. 23. represents a new species of this genus, which may be thus named and characterised *Latridius, nodifer*, piceo-niger, thorace angusto bicostato pone medium constricto; elytris striato-punctatis, pone medium bituberculatis. Long. corp. 1 lin. Found at Chiswick and Coombe, at the bottom of whitethorn hedges in the autumn.

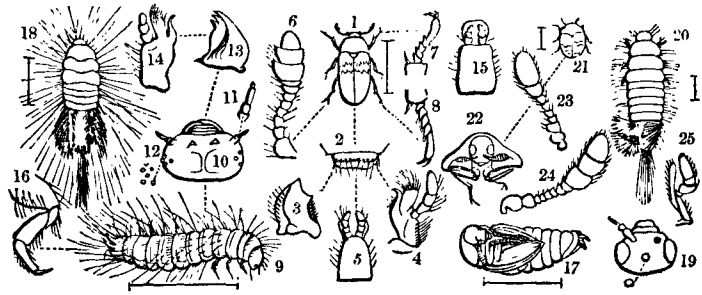
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† BIBLIOGR. REFER. TO THE DERMESTIDÆ.

Say, in Journ. Acad. Philadelph. t. iii.

Thunberg, in Nov. Act. Upsal. t. vii. (Monograph Anthrenus). — Ditto, Nov. Ins. Spec. in ditto, vol. iv.; — Nouv. Mem. Soc. Roy. Denmark, t. ii.; — also the general works of *Stephens, Curtis, Sturm, Gyllenhal, Fabricius, Panzer, Olivier, Herbst, Germar*, &c.

Fig. 14.



darius) is characterised by the partially contractile power of the legs, the tarsi not being folded upon the tibiæ when at rest, the latter being long and narrow. The labrum is very short, with a membranous tip (*fig.* 14. 2.); the jaws are short, thick, and toothed at the tip, and concealed beneath the labrum (*fig.* 14. 3.; *fig.* 14. 4. maxilla, 14. 5. labium of Dermestes); the antennæ are short, clavate at the tip, and not elbowed (*fig.* 14. 6.) The body is ovoid or oblong, thick, rounded at each end, and clothed with pile, scales or hairs, which give it a variety of tints; the head is short, and deeply immersed in the cavity of the thorax, which is trapezoid, and broadest behind. The tarsi are 5-jointed (*fig.* 14. 7. anterior, 14. 8. posterior tarsus). M. Brullé has very recently noticed the existence of a single minute tubercle upon the forehead of some of these insects, which has all the appearance of an ocellus. Mr. Curtis had, however, discovered its existence in the genera Megatoma and Attagenus in 1829 (*fig.* 14. 19. head of Tiresias serra; o, the ocellus). The perfect insects are of small size and obscure colours.

The name of the family is derived from δερμα, a skin; and is given to these insects in allusion to the ravages which their larvæ commit in dried skins, furs, &c. The perfect insects are found in the same situations as their larvæ, but they appear only to be destined to continue their species; they are very timid: their movements are slow and very irregular, and are suspended on the slightest danger, the insects admirably counterfeiting death. Some species are found upon old palings, under the bark of trees, &c.; and Megatoma undatum, which is met with in the last-mentioned situations, is said by Mr. Curtis, on the authority of Mr. Robinson, to eat holes in, and apparently to feed upon, the chrysalides of Noctuæ. The ravages of these insects are chiefly directed towards the skins and carcasses of animals of all kinds; thus the Dermestes

murinus is found in the bodies of moles stuck up in fields to dry, consuming all the fleshy and tendinous portions, leaving the animal a complete skeleton.* They also feed upon feathers, dried meats, bacon, the dried horns and hoofs of animals, meat in larders, books, paper†, &c.; escaping observation by their minuteness, and rendering precaution useless by their perseverance. The larvæ of Anthrenus are in like manner very injurious in collections of preserved insects. Although obnoxious in these respects, the insects of this family are of infinite service in the economy of nature, by causing the rapid decomposition of animal matter into a substance fitted for the improvement of the soil, and by their labours, united with those of the Silphæ, Necrophori, &c., destroying such portions of these remains as are left untouched by the Flesh-flies, which only consume the soft portions of the carcasses. Like the perfect insects, their larvæ are seldom observed upon the surface of the matters which they attack. So general, however, is the taste of some of these insects, that Mr. Kirby is recorded to have discovered the larvæ of Derm. vulpinus in some specimens of flexible asbestos called Amianth, and which they had perforated in various directions, undergoing their transformations therein. That these holes were not made merely for the purpose of the insect becoming a pupa therein is evident; since they are not very particular in selecting a spot for this purpose, not only becoming pupæ in the exuviæ of the animal they have devoured, but even under their own excrement. (See *Gœdart*, No. 114.; and *De Geer*, vol. iv. p. 196.)

* In some of the Egyptian mummies lately opened, a great number of dead specimens of several species of Dermestes have been discovered in the interior of the body, together with a number of their larvæ, also dead; hence, from the circumstance of these larvæ being found dead in a situation which appears at one time to have been congenial to them, I am induced to think that these insects must have found their way into the body previous to the final operation of embalmment, whereby they were destroyed. See Mr. Pettigrew's recent work upon Mummies, where one of these Dermestes and its larva (from which the hairs had been entirely rubbed off) are represented, with numerous details. See, also, Hope, in *Trans. Ent. Soc. London*, v. i.; and Atkinson, in *Trans. Linn. Soc.* vol. xiv. *App.* Latreille also tells us that the larva of Dermestes murinus frequents the nests of Philanthus apivorus, probably for the purpose of feeding upon the bodies of the bees stored up as food for this insect (vide *Latr. Hist. Nat. des Fourmis*, p. 320.). Linnæus also mentions that a perfect insect of this species crept out of the plumage of an owl which he shot in Lapland (*Lachesis Lappon.* vol. i. p. 206.).

† In the *Annales Soc. Ent. France*, 1837, p. 499., is an account of the ravages of a species supposed to be D. chinensis, the larva of which completely destroys books, paper, &c., in the island of Guadeloupe.

Moreover the holes were of various sizes. (*Phil. Mag.* No. 267.; and *Literary Museum*, vol. ii. p. 171.) These insects appear to be generally distributed; indeed, the Derm. vulpinus, which is common throughout Europe and America, was also discovered in Java by Dr. Horsfield: a circumstance evidently attributable, as Mr. MacLeay imagines, to the attendance of these skin-feeding insects upon man. I possess specimens of the same species from Chili and Brazil, as well as specimens found alive in London amongst Brazilian merchandise. The last-named species was, indeed, some years ago so injurious in the large skin warehouses of London, that a reward of 20,000*l.* was offered for an available remedy, without, however, any being discovered. The same insect, both in the larva and perfect state, has also been ascertained to be equally injurious to cork, an entire cargo of that article having been completely destroyed by an immense number of this insect, which fed upon it, as well as upon the timbers of the ship; a circumstance recently communicated by Mr. Bowerbank to the Entomological Society.

The larva (*fig.* 14. 9.) of Dermestes lardarius, the Bacon-beetle, is long, and gradually narrowed towards the extremity of the body, which is terminated by a truncate cone having a fleshy lobe at its tip, which is employed as a proleg; the body, exclusive of the head, is composed of twelve segments, each of which is clothed with long scattered hairs, and protected above by a coriaceous plate, having also a pair of short curved horny spines upon the last segment of the body; the head, (*fig.* 14. 10.) is scaly, with six small ocelli on each side (*fig.* 14. 12.), and two short triarticulate antennæ (*fig.* 14. 11.); the mandibles are short, but very robust, and with several teeth at the tips (*fig.* 14. 13.); the maxillæ are short, with two terminal lobes, the interior of which is a corneous hook, as in the imago; the maxillary palpi are very short, and 3-jointed (*fig.* 14. 14.); the labium (*fig.* 14. 15.) also closely resembles that of the imago; the legs are short and scaly (*fig.* 14. 16.).

These larvæ shed their skins several times, which subsequently remain extended, so as closely to resemble the larvæ themselves. They reside for the most part in skins and the carcases of animals, making sad havoc in collections of Natural History, and in the stores of the furriers, gnawing the roots of hairs and feathers, and thereby causing them to fall. These larvæ have been accurately described and figured by Herbst (*Natursyst.* vol. iii. and iv.), Gœdart (No. 124.), Frisch (vol. i. t. 10. pt. 3. pl. 18. and vol. i. pt. 5. t. 8, 9.), De Geer (*Mem.*

vol. iv. pl. 7.), Lyonnet (*Recherches Posth.* vol. i. pl. 11. Dermest. lardarius), Bouché (*Naturgesch. der Insecten*, i. 189. Larva Derm. murinus), Mieneken (*Naturforscher*, st. iii.), Meyer (*Voigt's Magaz.* 7 band. 4 st.). This form of larva is considered by Mr. MacLeay as at the very extremity of the Chilopodiform section, and that it is from it that we pass to the Chilognathimorpha. Some species of this family undergo the pupa state (*fig.* 14. 17. pupa of Dermestes) in the substances upon which the larvæ have fed, without forming any cocoon; others, however, as the Megatoma undatum, are said to spin a silken case. I have, however, found the last-named insect in the winter months, evidently just arrived at the perfect state, and still inclosed within the exuviæ of its larvæ, which had served it for a cocoon; a peculiarity which we shall also notice in Anthrenus. Mr. Waterhouse has also observed the same in Tiresias serra (*Ent. Mag.* vol. iii. p. 412.)

The larva of Attagenus Pellio, according to Latreille, is long, of a reddish-brown colour, and shining; clothed with hairs, those at the extremity of the body forming a tail. Its motions are very irregular, creeping along by fits and starts.

Latreille observes that the larvæ of the Dermestidæ closely resemble those of Anthrenus, the chief difference consisting in the fascicles of hairs at the extremity of the body in the latter. In Attagenus, however, as just noticed, the hairs form a tail, and the perfect insects, especially Attag. 3-fasciatus, bears a great resemblance to the perfect Anthreni. I have also observed that in a larva which I found under the bark of birch trees inhabited by Megatoma undatum, and which I have no doubt was the larva of that species, the extremity of the body is furnished with two bundles of hairs, which it expands like a fan, and to which it imparts a tremulous motion, so rapid as scarcely to allow the fans of hair to be perceived whilst it lasts. I have also found in the dried body of a Squilla (one of the Crustacea) a larva in all respects resembling that of Dermestes, except that the extremity of the body is not armed with the two hooks. I have also found the exuviæ of the larvæ of some species of Dermestes in boxes of Chinese insects. The larva of Tiresias serra (*fig.* 14. 18.) has been described by Mr. George Waterhouse in the *Entomological Mag.* vol. ii. p. 375. It is of an elongate-ovate, and depressed form, narrowed towards the tail, and covered with long brown hairs; the terminal segment of the body being also furnished with a long brush of

hair, and destitute of the two spines observed in the larva of Dermestes. It is found during the winter under the loose bark of elm trees, in company with a small spider which spins a web-like case, in which it resides, and upon which he believes the larva of the Megatoma feeds. Mr. Curtis says that in the winter it feeds upon Onisci or woodlice. The former writer has also noticed the peculiar structure of the abdominal segments, whereby the rows of hairs are elevated or depressed at will. These larvæ, therefore, much more closely resemble those of Anthrenus than of Dermestes.

The perfect Anthreni (*fig.* 14. 21. Anthrenus musæorum*) are often met with in flowers, especially those of Umbelliferæ, feigning death when disturbed, like the Byrrhidæ. In the larva state, however, as above noticed, they are much more injurious, especially in neglected museums, devouring the integuments uniting the bones, which soon fall from each other; skins, hairs, and the feathers of birds. The larva (*fig.* 14. 20.) is elongate-ovate, thick, somewhat leathery in its texture, and very hairy, especially towards the posterior extremity; the jaws are very strong and horny; the six legs are of small size. The hairs upon the bodies of these larvæ are arranged in small bundles along the sides, and the tail furnished on each side with a pair of tufts of larger size, which are laid when at rest upon the back; but when the insect is disturbed it spreads these out, so as somewhat to resemble a shuttlecock (in *fig.* 14. 20. the hairs on one side are represented shut, and on the other expanded); these hairs are of great service to the larva, enabling it to glide between the fingers when handled, as though covered with oil. The appearance of these larvæ under the microscope is very pleasing, the hairs upon the body being discovered to be furnished with still more minute hairs; whilst those forming the terminal brushes are individually formed of a series of minute conical pieces placed in succession, the base being very slender, and the extremity of each hair forming a large oblong knot placed on a slender footstalk†. Ac-

* The genus Anthrenus appears to be the connecting link between the Dermestidæ and Byrrhidæ, agreeing with the former in the habit of its larva, and with the latter in the contractility of its limbs, the antennæ (*fig.* 14. 23., 14. 24. varying in the sexes) being lodged, when at rest, in cavities at the sides of the prosternum (*fig.* 14. 22.); the tarsi are, however, exposed, and the tibiæ of all the legs fold upon the posterior surface of the thighs; whereas in the Byrrhidæ, the anterior tibiæ fold upon the anterior surface, and the four posterior tibiæ on the posterior surface of the femora, the tarsi being also lodged in a groove of the tibiæ.

† De Geer, Mem. vol. iv. pl. 8. Sturm's Deutchsl. Ins. Faun. vol. ii. pl. 36.

cording to Disderi (*Mem. Acad. Turin*, tom. xvi. p. 68.) there is no fixed period of the year for the deposition of the eggs by the female. They are nearly a year in attaining their full size, and it is chiefly in warm weather that their ravages are most extensive; they shed their skin several times, and it would appear that from the nature of their food they are unable to produce any silken or other materials for the formation of a cocoon, but in lieu thereof they retain the last skin of the larva, which serves for a cocoon, having first made a slit down the back, out of which the beetle when arrived at the perfect state makes its escape, having made a corresponding slit down the back of the pupa skin, thus leaving the skin of the pupa enclosed within the skin of the larva. (Latreille, in *Nouv. Dict. d'Hist. Nat.* vol. ii. p. 161.)

From the minute size of these insects, the greatest care is necessary, in order to prevent them from gaining admission into cabinets or boxes of insects, &c. It is serviceable to place boxes of insects attacked by them in tin cases, which may be then immersed in boiling water, whereby not only the larvæ but also the eggs are destroyed. The French entomologists make use of a machine recently invented for this purpose, called a necrentome. (*Ann. Soc. Ent. France*, 1837.) The larvæ appear to be insensible to the effects of camphor; indeed, I have found them actually harboured under the lumps of this material in my drawers. See also Disderi, in *Trans. Soc. Turin*, vol. iii. p. 54.

The third and remaining stirps of Rypophagous Pentamera, or the fifth of the Chilopodomorpha of *MacLeay*, is the BRACHELYTRA *, a

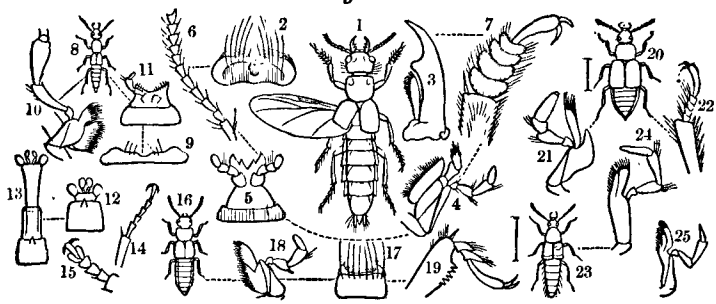
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* BIBLIOGR. REFER. TO THE BRACHELYTRA OR STAPHYLINIDÆ.

Paykull. Monogr. Staphyl. Sueciæ. Upsal. 8vo. 1789.
Gravenhorst. Coleopt. Micropt. Brunsvic. 8vo. 1802. — Ditto, Monogr. Coleopt. Micropt. 8vo. 1806.
Runde. Brachelytrorum Spec. Agri. Halensis. 8vo. 1835.
Sahlberg. Insecta Fennica.
Ahrens. Fauna Insect. Europæ.
Mannerheim, in Mem. Acad. Imp. Sc. St. Petersb. tom. i. 1831.
Latreille, in Nouv. Ann du Mus. vol. i. (Mem. on Denticrura or Oxytelides).
Ljungh, in Weber and Mohr. Arch. für Naturg. vols. i. and ii. (Mon. Stenus).
Laporte. Etud. Ent. No. 2.
Blondel, in Ann. Sc. Nat. 1827 (Prognathus).
Dalman, in Anal. Ent. (Zirophorus).
Wesmael, in L'Institut. 1834 (Harpognathus).

very extensive group, corresponding with the Linnæan genus Staphylinus, a tribe which appears, in point of rank and characters, to be of precisely equal value with the genus Carabus of the Swedish author; wherefore it ought also to be considered as a single family, for which the name of STAPHYLINIDÆ should be retained, and its subdivisions regarded as sub-families, as in the Carabidæ. The French and German entomologists having, however, preferred distinguishing their sections by names derived from the habits or structure of the contents thereof, have named this group Brachelytra (*Latr.*), or Microptera (*Gravenhorst*); the latter name being, however, inaccurate, as the wings are of a large size, is rejected in preference to the former. From their great numbers and frequent occurrence in England they have obtained a distinct English name, that of rove-beetles.

Fig. 15.



These insects are long, narrow, and depressed in form; the abdomen is much longer than the elytra, beneath which the wings,

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Newman, in Entomol. Mag. vol. ii. (Pseudopsis).

Boisduval and Lacordaire. Faun. Entomol. de Paris, 12mo.

Matthews, in Entomol. Mag. No. 22. (Centroglossa and Deinopsis).

Haliday, in ditto. No. 18. (Diglossa).

Germar. Ins. Sp. Nov. (Leptocheirus).

Nicolai. Dissert. Entom. Halle.

Perty. Delect. An. art. Brasil.

Westwood, in Jardine's Mag. Zool. and Bot. vol. ii. (Micralymma). — Ditto, in Royle's Description of the Himalayan Mountains. — Ditto, in Zool. Journ. Nos. 9. and 12.

Say, in Act. Soc. Roy. Upsal, vol. viii.

Erichson. Kafer Brandenb.

And the general works of *Stephens, Curtis, Gyllenhal, Olivier, &c.*

Note. — It is understood that Gravenhorst is at present occupied upon a general revision of the Brachelytra.

which are of a large size, are closely folded when at rest (*fig.* 15. 1. Staphylinus erythropterus, with one wing expanded); the head is large, and generally exserted; the jaws are very powerful; the outer lobe of the maxillæ is not palpiform, although with evident traces of articulation; the antennæ are rather short, and either of equal thickness throughout, or thickened towards the tips, which are not distinctly clubbed, as in the Necrophaga; the thorax is as broad as the abdomen; the anterior coxæ are greatly developed, giving an increased motion to the forelegs; the legs are robust, and the anterior tarsi are often dilated in the males; the abdomen, from being uncovered by the elytra, is of the same consistence on the upper as on the under surface, and from its length it is capable of great motion, and is employed in folding and unfolding the wings; the extremity of this part of the body is furnished with two vesicles capable of being protruded at will, consisting of two conical fleshy points clothed with hair, from which a vapour is emitted which is occasionally very unpleasant. Thus Mr. Kirby (*Mon. Apum. Angl.* vol. i. p. 136.) states that the scent emitted by Staphylinus brunnipes *Fab.* is a most singular mixture of the odour of spices with something indescribably fetid. Leon Dufour has given an account of the apparatus whereby this is secreted in the *Annales des Sciences Naturelles*, vol. viii. p. 16.

It is impossible at the present day to ascertain what was the real Staphylinus of the ancients. Gaza, indeed (but carelessly, acccording to Mouffet), asserts it to have been a kind of carrot; but Absyetus, a Greek writer, expressly mentions the Staphylinus as creeping about pastures with its tail elevated, as well as the noxious scent which it emits, which he tells us produces tumours in horses which may happen to have taken one into the mouth with their food, and for which Mouffet with great gravity gives a long remedy. The Staphylinus is also assimilated to the Spondylus, which Mr. MacLeay also considers to have been smaller Staphylinidæ allied to Goerius olens.

In the Linnæan system these insects immediately preceded the Earwigs, which were placed at the end of the order Coleoptera; but their habits and structure evidently point out their affinity with the Silphidæ, some of which have also the elytra abbreviated, and not entirely covering the abdomen. This affinity is especially evident in the largest species of each group, such as the Goerius, Emus, &c. amongst the Brachelytra, and Necrophorus and Necrodes amongst the Necrophaga; a circumstance of considerable interest as regards the

distribution of these groups, proving either that these species do not constitute the tpyes of these stirps, as has been generally supposed both from their size and habits, or that the ordinary definition of typical groups, namely, those which are furthest removed by their characters from the adjoining divisions, is not correct. In like manner the genus Micropeplus has been alternately placed amongst the Necrophaga and Brachelytra. Latreille in some of his works placed the Brachelytra in connection with the Hydradephaga; the relation between which may at first seem doubtful, but which appears to be confirmed by the great similarity between the larvæ of the two groups. (See *Heer. Obs. Ent.* p. 23.) The relation of the Brachelytra to certain Adephaga has been already pointed out; and it must be further noticed that from the anatomical researches of Ramdhor and L. Dufour, as well as from the structure of the manducatory organs, Mr. Kirby is induced to think the Brachelytra more predaceous than has been ordinarily considered, and as even more nearly allied to the Adephaga than to the Necrophaga, with which, however, they have many points of relation.

These insects run and fly with equal agility. They are very voracious, preying upon decaying animal and vegetable matters, especially fungi, agarics, &c., in which they chiefly reside; they are also found in profusion under heaps of putrescent plants, so that they may be regarded as amongst the most pre-eminently rypophagous insects. Some species are, however, found in flowers, others upon the margins of running streams, and others under the bark of decaying trees; in which latter situation I have found the singular species Siagonium 4-corne *Kirby* (*Introd. to Ent.* vol. i. pl. 1. f. 3.) in Kensington Gardens in profusion. Some also attack living insects, and in the collection of Mr. Ingpen I have observed a small species which still retains an Acanthia in its jaws. The exceedingly rare species of large size, Velleius dilatatus, is parasitic in the nests of the hornet (Vespa crabro), whence the secret of its rarity; other smaller but nearly equally rare species, Dinarda, Lomechusa, reside in the nests of ants. (See *Chevrolat*, in *Silberm. Rev. Ent.* No. 17.) One of the commonest, and at the same time largest insects of the family, is a black species, rather more than an inch long, commonly called the Devil's Coach Horse, Goerius olens, which is frequently to be seen running about garden walks, &c. On the least approach of danger this insect, like the rest of the group, immediately

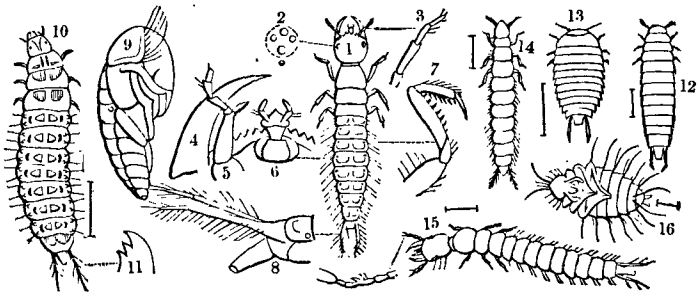
puts itself into a most ferocious-looking posture of defence, throwing the tail over the head like a scorpion, protruding the anal vesicles, elevating its head, and widely opening its long and powerful jaws.

Some of the species appear to prefer damp situations and the banks of running streams. Various Oxyteli, and especially the Steni, are thus subaquatic; they are also remarkable for the size of their eyes, and are probably predaceous in their habits. The motions of the last-named insects are curious. I have often observed them running for a short distance, and then suddenly stopping, alternately raising and depressing the abdomen, and then starting off again. Some species will even bear submersion under the tide for a considerable time (Hesperophilus, *Rudd. Entomol. Mag.* vol. ii.). Dr. Johnston of Berwick upon Tweed has also lately discovered a new insect in similar situations near that town, which I have described and figured in the *Mag. Zool. and Bot.* vol. ii., under the name of Micralymma Johnstonæ.

The geographical range of this group of insects is evidently confined to the temperate climes of the northern hemisphere. Thus in the first edition of Dejean's Catalogue, out of 434 Brachelytra twelve only were extra-European, whilst in the second edition out of 789 species 176 were extra-European; but of the latter number the majority are from North America. This circumstance, indeed, evidently proves the rarity of the insects; Dr. Horsfield, who collected so assiduously in Java, did not even bring home a single individual of this stirps. Mr. MacLeay endeavours to account for this fact by considering that the ants and white ants in tropical climates supply the place of these insect-scavengers of more temperate climates. M. Lacordaire also states that he found very few Brachelytra in Brazil (*Ann. Sc. Nat.*, June, 1830). The few species, however, which have been received from tropical climates are remarkable for the singularity of their forms and the splendour of their colours. Mr. Stephens has described not fewer than 800 species inhabiting this country. It is also to be noticed that in these, as well as in all the preceding groups of insects, it very rarely happens that the exotic species exceed those of our own country in size.

The eggs of these insects are of a large size, that of Goerius olens exceeding those of any other English insect, being a line and a half long and a line broad (*Introd. to Ent.* vol. iii. p. 90.). The larvæ bear considerable resemblance to the perfect insects, both in their structure and habits, being found in similar situations and

Fig. 16.



feeding upon the same substances. The body is long and narrow, with the head and anterior segments broadest; the thirteenth segment is succeeded by a conical tube (being a fourteenth segment), which is employed as a seventh leg; from the superior lateral angles of the thirteenth segment there also arise a pair of long slender conical and articulated setæ, having a few bristles scattered along their surface, evidently representing the peculiar anal appendages of the imago. In some species (as in the perfect insects) the head is narrowed behind into a distinct neck; the head is furnished on each side with several tubercular ocelli; the jaws are very powerful and forcipate, and the legs are moderately long. Gravenhorst, in the Preface to his *Coleoptera Microptera*, has noticed the great difficulty attendant upon the rearing of the larvæ of these and similar insects, and which he had failed in accomplishing; indeed, he had only noticed a single larva, which he regards as that of Goerius olens. Gædart has given two very characteristic figures of a larva, and of Creophilus maxillosus, which he describes as "præcedentis vermis conjux;" noticing, in his quaint style, the voracity of both. Swammerdam also mentions the Staphylinus, which "seeming of a middle nature between the beetle and Scolopendra, can very quickly kill earthworms with its teeth, and afterwards suck them. I preserved five species of it, together with the worm and nymph, which exhibits the parts of the future insect, but somewhat obscurely." There is also a memoir upon the larva of Staphylinus by M. Brez in the *Mémoires de Lausanne*, vol. iii. p. 13. See also *Frisch.* vol. i. pt. 5. t. 25. Mr. Walford, in the ninth volume of the *Linnæan Transactions*, published an account, accompanied by an admirable figure, of a small larva which infests wheat in its earliest stage of growth by eating into the young plant about an inch below the surface and devouring the central part, thus

occasioning considerable damage. Mr. Walford thought that this larva was the Wire-worm; but from its structure it is evident that the conjecture of Marsham (in the supplementary note) and of Messrs. Kirby and Spence, that it belongs to some of the Staphylinidæ, is correct. In a paper upon the Staphylinidæ, published in the ninth number of the *Zoological Journal*, I described and figured three larvæ as the types of three of the divisions of this group of insects; namely, that of Siagonium 4-corne, illustrative of the Omaliides (*fig.* 16. 12.), that of Philonthus —? illustrative of the Staphylinides, and another larva which I considered to be that of Aleochara fuscipes (*fig.* 16. 13.), but which Mr. Kirby, from its broader form, thought was that of one of the Nitidulidæ. Having, however, subsequently investigated the subject more closely, I published an additional notice in the twelfth number of the same work, wherein I detailed the reasons which induced me to retain my former idea. Mr. George Waterhouse has described and figured the larva and pupa of Quedius tristis *Gra.* in the *Entomological Transactions*, No. 1. pl. 3. The former is long, narrow; the head subquadrate, depressed, and rather broader than the succeeding segments, of which the prothorax is the largest; the antennæ are 4-jointed; the mandibles long, curved, and entire; the maxillæ elongate, narrow, far apart from the labium, and furnished with a small terminal lateral lobe, and with a short 4-jointed palpus; the terminal segment bears two rather short and slender articulated processes. In the pupa state (*fig.* 16. 9.), all the parts are soldered together; the abdomen is straight; the head and prothorax are suddenly bent forwards, the former touching the breast. Messrs. Kirby and Spence have figured one of these larvæ (*Introd.* vol. iii. pl. 18. f. 6.); but the species is not recorded, neither is the figure characteristic.

Bouché has described and figured the larvæ of Staphyl. æneus and variabilis, which resemble that of Quedius tristis, the anal appendages being rather more elongated; also the larva of Xantholinus punctatus *Gyll.*, which does not materially differ from the preceding, except that the prothorax is smaller, and the abdomen rather broader; also the larva and pupa of Oxytelus morsitans *Gyll.* The head of the larva (*fig.* 16. 14.) is small; the antennæ short and conical, the third joint having a small lateral appendage; the jaws are bidentate, the abdominal segments broader than those of the thorax, and the anal proleg not perceivable. The pupa is small, and attenuated at the hind part

of the body; with two long diverging setæ, arising from the anterior margin of the thorax, and with two short anal setæ.

I possess many larvæ belonging to this family, none of which, however, I have succeeded in rearing to the perfect state; some of them so strongly resemble the larvæ of the Dyticidæ in the general form of the body, and in the structure of the trophi, that it would be difficult, were it not for the aquatic habits of the latter, to decide to which group of insects they belonged. This is particularly the case with the larvæ of some of the larger species, which, as above noticed, in their perfect state most nearly approach the Silphidæ. One of the largest of these, which I have represented in *fig.* 16. 1., is upwards of an inch long, and is apparently the larva of Goerius olens, or Creophilus maxillosus (agreeing with the descriptions given of the former by various writers). The head and four anterior segments are scaly, the remainder being fleshy, with the sides rounded. The jaws (*fig.* 16. 4., 16. 5. maxillæ, 16. 6. labium in situ) are short, and fold upon the front margin of the head (*fig.* 16. 2. the eyes, 16. 3. the antennæ, and 16. 7. one of the anterior legs); in others, however, the head is more concave, and the jaws are rather bent upwards, and do not meet so closely; in these the body is of nearly equal breadth throughout. In some smaller and apparently younger individuals, the anal setæ are much elongated, sometimes nearly equal to half the length of the body; these occasionally consist of two or three joints (*fig.* 16. 8.); but in others there are as many as eight articulations. The head, in some species, is smaller than the following segment, as in the larva of Siagonium 4-corne (*fig.* 16. 12.). The species which feed upon decaying vegetable matter appear to exhibit this difference, as was especially the case in a larva (*fig.* 16. 10.) of which I found many specimens devouring turnips in the winter months, and in which the body is more fleshy than in the preceding, and the mandibles bidentate (*fig.* 16. 11.). In several pupæ of these insects which I possess, the lower wings are folded over, and meet upon the breast, and consequently extend far beyond the elytra, which are distinctly perceived to reach about one third of their length; this is the more remarkable, since in other beetles which have the wings much longer than the elytra the former are folded up in this state, so as not to extend beyond the latter: the head is closely applied to the breast; and all the limbs are so intimately folded together, that the insect appears to be enveloped in a single skin.

Dr. Johnston of Berwick-upon-Tweed has communicated to me specimens of the larvæ (*fig.* 16. 15.) and pupæ (*fig.* 16. 16.) of a Staphylinideous insect, which I have not the least hesitation in considering as those of Micralymma Johnstonæ (having been found in company with that species far below high-water mark on the sea coast), and of which I have published figures and descriptions in the *Mag. Zool. and Bot.* vol. ii.

M. E. Blanchard has published a good description and figures of the larva and pupa of Goerius olens (*Guér. Mag. Zool.* pl. 165.). The former is carnivorous, very bold, attempting to seize whatsoever approaches, and attacking its own species, which it always seizes between the head and first segment, and then sucks the juices, and afterwards devours the whole body. They are to be found in this state during the winter months, till May, when they form a cell in the ground, in which they become pupæ, which state lasts about fifteen or sixteen days. Dr. Heer has also published a still more elaborate account of the structure and habits of the same larva and pupa (*fig.* 16. 9. *Observ. Entomolog.* 1836); the former of which constructs a cell sometimes a foot deep, in which it takes up its abode, for the purpose of seizing insects which may happen to creep over its aperture, or fall into it. When about to cast its skin, it closes the mouth of its hole with earth. Dr. Ratzeburg (*Die Forst-Insecten, Kafer*, pl. 1. f. 14.) has also figured the larva, pupa, and imago of the same insect, with various details.

M. Lacordaire (*Ann. Soc. Ent. France*, i. p. 358.) has described a larva, supposed to be that of Zirophorus longicornis, found beneath moist bark in a state of decomposition, in which the larvæ were very abundant. It was of a contracted form, somewhat conical at each end; the mandibles very strong, and bifid at the tips, the superior tooth being elevated, as in the imago. Each segment of the body supported a pair of tubercles, placed transversely. Its movements were slow. This description scarcely, however, appears to me to accord with that of a Staphylinideous larva.

In the *Mag. of Nat. Hist.* (No. 23.) is an account of a specimen of Staphylinus hirtus, having a slender horn growing out of one of the eyes. Acrel (*Nov. Act. Upsal*, vol. vi. p. 115.) has given an account of various species of Staphylinidæ, which had been ejected by a female patient.

In the first edition of the *Règne Animal*, Latreille divided this fa-

mily into four sections: 1. Fissilabres (Staphylinus, &c.); 2. Longipalpi (Pæderus, Stenus, &c.); 3. Applati (Oxytelus, Omalium, Aleochara, &c.); and 4. Microcephali (Tachinus, Tachyporus, &c.): the Pselaphi, although considered as allied to Aleochara, being formed into the last primary group in the order, and named Dimera, from the tarsi being erroneously regarded as having only two joints. These sections were adopted as families by Mr. MacLeay in the *Annulosa Javanica*, with the observation, "The apparently dimerous tarsi of the Pselaphidæ are not of themselves sufficient to throw these insects out of the stirps; for we may perceive the articulations of the tarsi to disappear in Oxytelus, and several genera of the neighbouring family, which the tarsal system, with its usual inconsistency, places widely apart from the Pselaphidæ." In my Memoir upon the Brachelytra, published in 1827, I suggested that Aleochara ought to be introduced into the same family as Tachinus; and that Oxytelus and its allies, and Elonium, Omalium, &c. ought to form distinct sections. In the second edition of the *Règne Animal*, 1829, Latreille added another section for the reception of Oxytelus, &c., under the name of Denticrura. The primary division of the order, Dimera, was abolished; but the Pselaphi were still placed at the end of the order, as a family of Trimerous beetles. In 1830, Mannerheim published a Memoir upon the Brachelytra; wherein he proposed six sections, named Staphylinides, Stenides, Oxytelides, Omalides, Tachinides, and Aleocharides, omitting the Pselaphi. Mr. Stephens followed Mr. MacLeay, adopting five family groups; namely, Pselaphidæ, Tachyporidæ, Staphylinidæ, Stenidæ, and Omalidæ, placing the Aleocharæ in the second family, and the Oxyteli with the Stenidæ. As these stirps do not, however, appear to be consistent with nature, I have adopted the later views of Latreille; placing, however, the Aleocharæ with the Tachyporidæ, and considering these groups, with Mannerheim, as tribes or subfamilies, named after the chief genus in each; to which the Pselaphi must also be added, as a sixth subfamily.

The first of these subfamilies, STAPHYLINIDES *Mann.* (Fissilabra *Latr.*, Staphylinidæ *MacL.* and *Steph.*), comprises the largest species in the family (*fig.* 15. 1. Staphylinus erythropterus *L.*); and which are characterised by the large size of the head, which is porrected, and formed behind into a narrow neck; the thorax is quadrate or subovate, sometimes rounded or cordate-truncate. The upper lip

(*fig.* 15. 2. labrum of Goerius olens) is longitudinally slit in the middle. The anterior tarsi of the males (*fig.* 15. 7.) are often dilated; and the maxillary palpi are short, filiform, and distinctly 4-jointed (*fig.* 15. 4.). The antennæ (*fig.* 15. 6.) are inserted between, or in front of, the eyes. The legs are generally spinose, and the tarsi 5-jointed. The mandibles (*fig.* 15. 3.) are long, and furnished on the inside with a membranous ciliated appendage (*prostheca* K. and S.). The labium and its parts, in the same insect (G. olens), are represented in *fig.* 15. 5. The species are usually found under dead leaves, stones, dung, &c., or are seen flying in the hot sunshine.

The second subfamily, Stenides *Mann.* (Longipalpi *Latr.*, Stenidæ *MacLeay*, *Steph.*), is distinguished by the integrity of the labium (*fig.* 15. 9.); the great length of the maxillary palpi (*fig.* 15. 10.), which are clavate, and apparently 3-jointed, the fourth joint being very minute, and almost entirely concealed within the extremity of the preceding. The head is large and exserted, as in the foregoing subfamily, with a short neck (*fig.* 15. 8. Pæderus riparius, *fig.* 15. 11. labium of the same). The tarsi are 5-jointed, in which respect they differ from the Oxytelides (*fig.* 15. 14. anterior tarsus of Stenus biguttatus, *fig.* 15. 15. ditto St. clavicornis); the mandibles also are long, acute at the tip, and internally furnished with several teeth. These insects are of a smaller size than the majority of the preceding subfamily; they are also often handsomely variegated in their colours. They frequent the margins of water and other damp situations, and run with great agility, their large eyes giving them a well marked character. The species of the genus Stenus exhibit a very remarkable structure in the lower lip, which is exceedingly elongated, and capable of exsertion to the length of half the body. According to Dr. Thion, who has published a Memoir on this subject in the *Ann. Soc. Ent. France*, 1835, the membranous elongated lip is articulated in the centre, the basal part forming a tube for the reception of the terminal portion. Mr. Curtis's figure of this structure (*Brit. Ent.* pl. 164. f. 4.) is more satisfactory. My *fig.* 15. 12. represents the instrumenta labialia of Stenus biguttatus in a retracted, and *fig.* 15. 13. in an exserted state.

The third subfamily, Oxytelides (or the Denticrura of *Latreille*, by whom a valuable Memoir was published in the *Nouv. Annales du*

Muséum), is characterised by the spinose or dentate anterior tibiæ (*fig.* 15. 16. Oxytelus morsitans, and *fig.* 15. 19. apex of the anterior tibia and tarsus of the same insect) on the outer margin; the terminal joint of the tarsi is longer than all the preceding joints, of which the articulations are indistinct, the tarsi appearing to be only 3-jointed. In the posterior tarsi of the same species Latreille states that he distinctly observed five joints; this part of the leg is not variable according to the sex. The head is exserted, the labrum entire (*fig.* 15. 17.); the maxillary palpi short, 4-jointed (*fig.* 15. 18.); the body is linear, depressed, or cylindric.

The species, as the structure of their forelegs indicates, burrow under ground; the tarsi being folded back upon the tibiæ. Some species (Trogophlæus *Mann.*, Siagonium,) reside under the bark of trees, or in fungi, and others in animal excrements. The species of the exotic genera Zyrophorus and Osorius, also, as observed by M. Lacordaire in South America, are found under the bark of rotten trees, where they form cylindric galleries in every direction. The species of Bledius are found upon our coast, burrowing in the sand; as are also some of the species of Hesperophilus, of one of which (H. arenarius) Mr. Rudd has published a notice in the *Entomological Magazine* (vol. ii. p. 180.), and which upon one occasion he captured in immense profusion flying below high-water mark, where he ascertained they were able to remain unhurt half an hour during the rising of the tide, and which are preyed upon by a species of Dyschirius, which is equally powerful in burrowing into the sand. The males of this genus, of Siagonium, and some others, have the head armed with horns; but it is a remarkable circumstance that these cornuted individuals appear to be of two distinct kinds: in some, which are always the largest individuals and the fewest in number, the horns are much more developed than in the other males, which are much smaller; the latter have, indeed, been regarded by some authors as neuters. Out of fifty males of Siagonium which I captured in Kensington Gardens, I was not able to find a single individual intermediate between these two kinds of males. The females are also much smaller and far more numerous than the opposite sex. I have also seen some male specimens of Bledius, in which the central horn of the thorax is very long, but the horns of the head are quite rudimental; and others, in which the thoracic horn is much shorter, whilst the protuberances of the head are long, and obliquely elevated; these individuals being

found in the same locality. See further hereon, Burrell and Haworth, in *Entom. Trans.* vol. i.; Kirby and Spence, *Introd.* vol. iv. p. 166.; my additional observations on the Brachelytra, in *Zool. Journ.* No. 12., and Stephens. *Illustr. B. E. Mand.* iii. 366.

The genus Coprophilus *Latr.* (*R. An.* 2d edit., Elonium *Leach*) appears to connect the Oxytelides and Omaliides, having the form of an Oxytelus and the maxillary palpi of Omalium. In Trogophlæus *Mann.* the tibiæ are unarmed.

The fourth subfamily, OMALIIDES (Applatis *Latr.*), is distinguished by the flatness and breadth of the body (*fig.* 15. 20. Omalium rivulare), which is generally of small size, and of black or obscure colours; the tibiæ are not externally spinulose; the head is exserted; the upper lip entire; the maxillary palpi 4-jointed (*fig.* 15. 21.), and the tarsi distinctly 5-jointed (*fig.* 15. 22.); the elytra are comparatively larger than in the other subfamilies, those of Anthobium, a genus which frequents flowers, nearly covering the abdomen, whence Marsham introduced this species into the genus Silpha. The species in general are found in decaying vegetables, dung, moss, &c. The type of the genus Lesteva was named Staphylinus caraboides by Linnæus; and from its resemblance to some of the subcortical species of Brachinides, Mr. MacLeay was induced to regard it as constituting the connecting link between the Geodephaga and Brachelytra, and thus effecting the circularity of the arrangement of the Chilopodomorphous Coleoptera.

Germar, in the fourth volume of his *Magasin der Entomologie*, p. 410., noticed the remarkable fact that some species of Omalium are furnished with a pair of posterior ocelli; and Dalman and Kirby (*Introd.* iii. 506.) also observed them in some species of Lesteva. They have been regarded by some writers merely as tubercles; but on examining them with a strong lens, they appear to me to present all the appearance of ocelli, being very conspicuous in the black species, in which they are of a red colour.

The fifth subfamily, TACHYPORIDES (corresponding with the Microcephali, and genus Aleochara *Latr.*, the tribes Tachinides and Aleocharides of Mannerheim, and the family Tachyporidæ of MacLeay and Stephens), is distinguished by having the head generally deeply immersed in the thoracic cavity, without any distinct neck (*fig.* 15.

23. Boletobius atricapillus); the thorax is broadest behind; the maxillary palpi are 4-jointed, and generally acute (*fig.* 15. 24.); the body is short and thick, approaching towards an elliptic form; the elytra often cover more than half the abdomen; the tarsi are 5-jointed, and the antennæ are never inserted beneath the lateral or elevated margin of the head. These insects are of small size, and are very numerous; they frequent fungi, boleti, and other decaying vegetable matter; some are found in dung, and others amongst bones. The species of Lomechusa *Grav.* are found in the nests of ants. (Nicolai, *Dissert. inaug.* p. 43.; and Silberm., *Rev. Ent.* No. 17.)

The chief character by which Mannerheim distinguishes the Tachinides from the Aleocharides (*fig.* 15. 25. maxilla of Aleochara fuscipes) is the place of insertion of the antennæ, which in the former is in front of the eyes, and in the latter between the anterior part of the eyes; in the former, moreover, the legs are spined, and the abdomen deflexed or straight, and in the latter the legs are simple, and the abdomen turned upwards. The genera Diglossa, Deinopsis, and Centroglossa exhibit some singular modifications of form in the parts of the mouth (vide my observations thereon in the *Ent. Mag.* No. 22.). Dr. Erichson has recently submitted the Aleocharides to a careful revision in his *Kafer der Mark Brandenburg.*

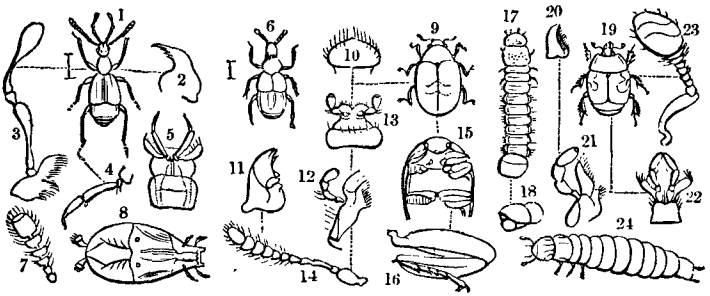
The sixth and last subfamily of the Brachelytra is the PSELAPHIDES* (corresponding with the section Dimera of Latreille's early works,

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* BIBLIOGR. REFER. TO THE PSELAPHIDES.

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Erichson. Kafer Brandenb.
St. Fargeau and Serville. Encyclop. Méthodique, vol. x.
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Dumeril. Consid. Gen.
Sturm. Catal. Mein. Ins. Samml.
Illiger. Kafer Preussens.

Fig. 17.



and with the family Pselaphidæ of MacLeay and Stephens.) These insects are extremely minute, but highly interesting, presenting several very peculiar modifications of structure; so that it is not surprising that they should have occupied the attention of several monographers, as Reichenbach, Leach, Denny, and Aubé. The body is generally short and robust (*fig.* 17. 1. Pselaphus Heisii); the tarsi very slender, with only three joints, of which the basal articulation is very minute (*fig.* 17. 4.), and they are generally terminated by a single claw; the head is narrowed behind the eyes; the maxillary palpi are very greatly developed, being, in the typical genus, as long as the antennæ, and much thickened at the tips (*fig.* 17. 3.). These organs have been described by Reichenbach and Leach as being either 3 or 5-jointed; but it is evident that the real typical number of joints (4) in these organs also prevails in these insects. The mandibles are acute and denticulated (*fig.* 17. 2.). The elytra are about half the length of the abdomen, much broader than the thorax, and folded at the base. The antennæ are clavate, and the eyes very prominent. The lower lip is furnished with two slender lobes, and a pair of very short palpi (*fig.* 17. 4. lower lip of Bryaxis, from Schmidt, the repre-

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Say, in Journ. Acad. Nat. Sc. Philad. vol. iv.
Aubé, in Guérin's Mag. Zool. vol. ii.
Germar. Mag. Entomol. vol. iii. (Claviger.)
Dalman. Act. Holm. 1820 (Articerus).
Gory, in Guérin's Mag. Zool. (Metopius = *Marnax* Lap).
Laporte. Etudes Entomol. No. 2.
And the general works of *Stephens, Curtis, Gyllenhal, Paykull, &c.*

sentations given of this part by Curtis and Aubé not being sufficiently precise). Some of these insects present several remarkable sexual peculiarities, respecting which authors do not appear to be agreed. Thus, one sex, in Arcopagus, has the anterior tibiæ emarginate, and the basal joints of the antennæ angulated, which Curtis regards as indicating the male, and Denny as the female. In one sex of Tychus the fifth joint of the antennæ is dilated. In the Continental genus Ctenistes *Reichenb.* the three terminal joints of the maxillary palpi are produced into a long and acute spine, which is supposed to be sexual. From the recent investigations of Erichson (*Kaf. Mark Brandb.* p. 268., and Weigmann *Archiv.* 1837, p. 30.), Aubé (*Mon. Pselaph.*), and De Motchoulsky (*Guérin, Mag. de Zool.* pl. 171.), it would also appear that uncertainty exists as to the sexual or specific characters of Bryaxis sanguinea; Erichson regarding B. laminata (distinguished by its singular metasternum) as a mere variety.

These minute insects are generally found during the winter and spring months in moss; they are also occasionally taken in the sweeping-net off grass, and are supposed to feed upon Acari. They run and fly with agility; when in motion they make use of their long palpi as instruments of touch, whence the origin of their family name. I have taken nearly all my specimens of the G. Euplectus on the wing.

The Continental genus Claviger *Preysl.* (*fig.* 17. 6. Claviger foveolatus *Mull.*) appears to be the most imperfectly organised of all the known Coleoptera: the antennæ are only 6-jointed (*fig.* 17. 6.); the eyes appear to be wanting; the maxillary palpi are without articulations, and some other parts of the mouth appear to be obsolete. They are generally found in the nests of Formica flava*; and M. Wesmael, to whom I am indebted for specimens, has observed that the ants guard them with care, occasionally taking them up in their jaws when they would escape; and he considers it not improbable that they secrete a fluid, analogous to that of the Aphides, from the setæ at the extremity of the elytra (*Encycl. Method.* vol. x.). Such, indeed, is also the statement of Muller (who has published an interesting memoir on this species in Germar's *Magazin der Entomologie*, v. iii. t. 2.), and by whom the mode of proceeding adopted by the ants

* As the Form. flava is a common British species, it is not improbable that the Claviger may be discovered to be indigenous by carefully examining the nests of this or some other species of ant.

to obtain the gummy secretion is described, as well as the more curious fact, that the ants, in return, feed the Clavigers from their own mouths. Muller also described and figured the exuvia of the pupa of the Claviger, and which is of an oval shape (*fig.* 17. 8.), with the posterior extremity truncate, and furnished with two small lateral appendages, as well as with two or three frontal clavate appendages, being supposed to be the sheaths of the antennæ. At the posterior part of the body, which appears to be multi-articulate, are the exuviæ of two articulated legs on each side. An elaborate memoir upon this genus, with highly magnified figures, has been published by Schmidt. The genus Batrisus appear also to be attached to ants' nests. (See Chevrolat, in *Silb. Rev. Ent.* No. 17.) Dalman has described a genus, Articerus, observed in gum copal (or anime ?); in which the antennæ consist of a long and single cylindric joint, and the eyes are wanting, and has proposed to form this genus and Claviger into a separate family (*Swed. Trans.* for 1825, pl. 5. f. 12.). M. Aubé has also communicated to me a notice of a genus closely allied to Articerus, but possessing eyes.*

The second general division of the Pentamerous Coleoptera is one which in the present state of the science can but be provisionally adopted, and which, according to the views of MacLeay, comprises those species whose larvæ resemble the Iulidæ in having a long and almost cylindrical body, the posterior extremity of which is curved beneath the breast, so that the larva when at rest lies upon its side. From thus imitating the Chilognatha, Mr. MacLeay has given to this group or stirps the name of CHILOGNATHOMORPHA, citing the larvæ of Scarabæus and Lucanus as examples. Like the Chilopodomorpha, those beetles, which have chilognathiform larvæ are generally pentamerous. "The Wire-worm, or larva of Elater segetis," according to Mr. Kirby, "as to shape, best resembles the full-grown Iulus and those of the Petalocera the young one;" whilst Mr. MacLeay states that "the tendency of Chilognathiform larvæ is herbivorous, having among them Lucanus, Ptinus, Byrrhus, Hister, Elater, Buprestis, and part of Tenebrio and Dermestes:" the passage from the Chilognathiform to the Vermiform groups being supposed to be effected by means of the genus Bostrichus. Mr. MacLeay did not, however, venture to designate the

* Nordmann's work on the Brachelytra, containing many new, chiefly exotic, species, has just arrived in this country.

primary groups of the Chilognathomorpha, nor assign a rank to its different sections, although he was inclined to think that Scarabæus, Lucanus, and Hister were all referrible to one type, which he provisionally named Acanthopoda, and which he accordingly united in one table in the *Horæ Entomologicæ*, p. 25.; in which Hister and Lucanus were united into a group named Rectocera*, and Scarabæus under the name of Petalocera, divided into two sections, supposed to be of equivalent rank with the two preceding. Mr. MacLeay, however, subsequently admits that the only mode of accomplishing the primary distribution of the Chilognathomorpha, is by investigating the genera Ptinus, Buprestis, Elater, and Dermestes on the same principle as he had previously pursued with the genus Scarabæus.

Being unwilling to trust myself in the solution of this difficult question, and observing that the group as sketched by Mr. MacLeay nearly corresponds with the two groups Lamellicornes (Cordylocerata) and Serricornes of *Latreille* (Priocerata), I have preferred treading in the steps of the last named author, and have adopted his distribution of these groups with some slight modifications, commencing with such of his Clavicorn beetles as have not been already described (Byrrhidæ and Histeridæ); which last, as Mr. MacLeay has shown, are closely allied to the Lucanidæ amongst the Lamellicornes, from whence, by means of some of the Cetoniidæ and Rutelidæ, an evident approach is made to the Buprestidæ amongst the Serricornes. Mr. Stephens has introduced the three following groups:—

1. Antennæ terminated in a solid or perfoliated club	Clavicornes	(Cordylocerata *W.*)
2. Antennæ terminated in a lamellated mass	Lamellicornes	(Cordylocerata *W.*)
3. Antennæ serrated along their whole length	Serricornes	(Priocerata *W.*)

The first of these three groups comprises the two families, Byrrhidæ, having straight antennæ, and Histeridæ with elbowed antennæ.

The first family, Byrrhidæ† *Leach*, is of small extent, corresponding

* Not only is this name improper, from combining two distinct languages, but also liable to great uncertainty, the Petalocera being actually described as having the "antennæ rectæ" in the table alluded to above.

† Bibliogr. References to the Byrrhidæ.

Sturm. Deutchsl. Fauna, vol. ii.

Leach, in Linn. Trans. vol. xiii. (Murmidius).

nearly with the Linnæan genus Byrrhus. The body is short, oval, or rounded, very convex, and generally covered with short sericeous pile (*fig.* 17. 9. Byrrhus pilula, 17. 10. labrum, 17. 11. mandible, 17. 12. maxilla, and 17. 13. labium of the same). The antennæ are more or less gradually clavate, the club not being solid (*fig.* 17. 14.): the prosternum is produced in front (*fig.* 17. 15. body beneath); the elytra cover the body; the legs are perfectly contractile, that is, the tarsi are capable of being laid closely upon the surface of the tibiæ which are broad and compressed; and the latter upon the femora, which, when the insect is alarmed, are entirely lodged in cavities on the under side of the body for their reception (*fig.* 17. 15. and 17. 16. hind leg partially shut up, and seen from within).

These insects are found on the ground, especially in sand pits in the spring, in foot-paths, &c.; on the slightest approach of danger they instantly fold up their antennæ and legs as above described, and which are thus so completely concealed that the insect appears more like an oval seed or pill, whilst thus counterfeiting death as their means of defence: hence the common name of Pill-beetle which has been applied to them. Some species (Nosodendron, Trinodes) are found under the bark of decaying trees in situations where there is an exudation of sap.

The larvæ of a variety of the common species (Byrr. pilula), discovered by M. Wandouer in moss, is mentioned by Latreille as being of a lengthened and narrow form, with the head large, the dorsal plate of the first segment large, and the two terminal segments larger than the others. Mr. Ingpen has communicated to me specimens of a larva (*fig.* 17. 17.), three quarters of an inch long when alive, found creeping about the foot of the iron palisades of one of the squares in London, and which agrees with the description given by Latreille: the body is long, narrow, and subcylindric, with the head and large dorsal plate of the first thoracic segment horny; the nine following segments are short, and of a more membranous consistence, with a few

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Goeze, in Naturforscher, St. 8.

Hope, in Trans. Ent. Soc. No. 1. (Microchætes).

Germar. Insect. Sp. Nov. (Ceutocerus).

O. Fabricius, in Mem. Soc. Roy. Denmark.

Charpentier. Horæ Ent.

Dufour, in Ann. Sc. Nat. 2d series, vol. i. p. 60.; and the general works of *Gyllenhall, Paykull, Stephens, Curtis, &c.*

short hairs scattered upon them; the two terminal segments are longer and more firm, the thirteenth segment being somewhat truncate, and furnished beneath with two large sub-globose fleshy tubercles serving as anal prolegs: this segment of the body is often curved downwards (*fig.* 17. 18.). The feet are six in number, and short; the jaws strong and bifid at the tips; the antennæ 3-jointed, short, and capable of being drawn in together and concealed, as well as the labrum, beneath the clypeus. They shed their skins; but I did not succeed in rearing them to the perfect state.

This family is nearly allied to the Dermestidæ*, the genus Anthrenus having been alternately placed in one or the other of these two groups; and, indeed, Latreille in his 'Genera' included Megatoma and its allies in the Byrrhidæ. Dr. Leach has described a minute, but very interesting, insect, one twenty-fourth of an inch long, which he referred to this family under the name of Murmidius ferrugineus (*Linn. Trans.* t. xiii. p. 41.), which he discovered alive in considerable numbers in a box of seeds and fruits received from China, attaching itself more particularly to such as contained saccharine matter. The antennæ are 10-jointed, the basal joint large, and the last forming an abrupt subglobose club; and the tibiæ are abruptly acuminate at the tip. This insect is, I apprehend, identical with the Ceutocerus advena, *Schüppell* (*Germ. Nov. Ins. Sp.* vol. i. pt. 1. f. 2.), of which Latreille observes, that it appears allied to the Histeridæ in the antennæ and legs; but the mandibles are not pointed, and the elytra entirely cover the abdomen. The genus Oomorphus *Curtis*, first indicated by Latreille (*Règne An.* vol. iv. p. 313.), is also interesting as regards its affinities; the third tarsal joint being bilobed, and the fourth very minute; the antennæ are terminated by a 5-jointed club, of which the second joint is however smaller than the others, thus approaching the Anisotomidæ. With Lamprosoma or Eumolpus the relationship, suggested by Mr. Curtis, appears of the most distant kind. Throscus, also, has been often referred to this family with which it agrees, in having clavate antennæ, and the prosternum advanced in front. It appears, however, to be more nearly allied to the Elateridæ, probably forming a link between these two families.†

* Mr. Kirby unites the Byrrhidæ with the Necrophaga in the Fauna Boreali-Americana.

† See observations on this genus in the *Entom. Hefte*, 2d part.

The second family, HISTERIDÆ* *Leach*, corresponding with the Linnæan genus Hister, is one of the most natural groups of beetles, distinguished by the very hard consistence of the body, which is generally of a square or oblong-quadrate form, and with a highly-polished surface (*fig.* 17. 19. Hister 4-notatus). The antennæ are short, strongly elbowed at the extremity of the long basal joint, and terminated by a large and solid club, composed of three joints, closely soldered together (*fig.* 17. 23.); the mandibles are very robust, horny, and exserted (*fig.* 17. 20.); the maxillæ (*fig.* 17. 21.) are elongated, bilobed, the lobes being strongly setose; the labium (*fig.* 17. 22.) is bipartite and setose; and the palpi are filiform; the prosternum is often produced in front like a neckcloth; the legs are more or less dentate, the two posterior pairs being inserted widely apart; the elytra are generally short and truncate, leaving the extremity of the abdomen exposed.

Like the insects of the preceding family, the Histeridæ have the power of contracting their limbs and counterfeiting death, whence their names of *Mimic Beetles*, and *Hister*, the latter evidently derived from the Latin word Histrio, a stage mimic.

These insects are of small size, seldom exceeding one third of an inch in length; their colours are generally black and shining; some few have the elytra ornamented with blood-coloured, or pale buff spots, and a few exhibit metallic tints. They feed upon decaying vegetable and animal matter, and are found very abundantly in the spring in the dung of horses and cows; other species, whose flattened bodies

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* BIBLIOGR. TO THE HISTERIDÆ.

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Germar. Mag. vol. i. and iv., and Ins. Spec. Nov.
Stephens, Gyllenhall, &c.

are admirably adapted to their mode of life, reside beneath the bark of trees, one of which (Paromalus picipes), according to Dalman, is parasitically attacked by Pteromalus micans (*Swed. Trans.* 1822). In their motions, they creep but slowly, but fly well. Cadet de Vaux, in his *History of the Mole*, observes that, almost as soon as it is dead, it is attacked by a number of Histers, especially the H. æneus, which strip off the fur almost as clean as though it were shaved with a razor. Latreille mentions, that a German author has stated that the larger individuals attack and kill the weaker, and deposit their eggs in their bodies, a statement of great improbability. Some of the more minute species are constantly found as residents in ants' nests (Chevrolat, in *Silb. Rev. Ent.* No. 17.). The larvæ of such species as have been observed (Hister merdarius and cadaverinus) feed, according to Latreille, upon the same substance as the perfect insect. They are linear, depressed, and nearly smooth, of a soft consistence, and a dirty white colour, with the exception of the head and first segment of the body, which are covered with a scaly reddish-brown skin, and are longitudinally sulcated. They are furnished with six short legs, and the body is terminated by two biarticulated appendages, and an elongated anal tube. Paykull has, however, given a more dilated account and figure of the larva of H. merdarius (*fig.* 17. 24. from Paykull's *Monograph*). The legs are short; the mandibles robust, and the antennæ and palpi short; the abdominal, as well as the two posterior, thoracic segments are of a dirty white, with various waived impressions and hairs disposed in transverse rows on each side of the ventral segments; there is, on the under side, a kind of fleshy tubercle, serving for progression. It is five inches long, and is found in moist cowdung, in the drier parts of which, at the end of the summer, it forms a cell, very smooth within, in which it becomes a pupa, without, however, entirely casting off the skin of the larva; thus resembling the Anhreni; the pupa is of a pale brown colour. The same author has also figured another larva, as that of the genus Hololepta; but Leach (*Enc. Brit. Suppl.*) and Latreille have shown that this is erroneous, and that the figure represents the larva of one of the Syrphidæ.

Mr. MacLeay, as above stated, has clearly proved the relation existing between the Histeridæ and Lucanidæ, by a comparative examination of their respective characters, as laid down by Latreille. Their habits, however, and general appearance, remove them to a considerable distance, although Hister (Oxysternus *Erich.*) maximus approaches such

of the Lucanidæ as L. alces. Their internal anatomy, also, as might be expected, exhibits a much nearer approach to the Silphidæ*, as proved by Dufour and Latreille; and, indeed, Hister possesses many characters in common with Necrophorus. With some of the Byrrhidæ, and especially with some new American species in my collection, allied to Nosodendron, they exhibit a close agreement in the structure of the under side of the thoracic segments. The G. Onthophilus presents some of the characters of Micropeplus, amongst the Nitidulidæ. The curious American genus Trypanæus (Bostrichus thoracicus *Fabr.*, and Hister proboscideus *Pk.*) is also serviceable in the pointing out other relations; resembling, in its cylindrical body, and the solid club of its antennæ, some of the Xylophaga; whilst the cornuted thorax of the males calls to mind Sinodendron and some of the Lamellicornes.†

Mr. Kirby regards the Histeridæ as an osculant group, and as the "stepping-stone, on the one side, from the Necrophaga, and on the other, from the Philhydrida to the Lamellicorn tribes; but considers that they diverge into two branches, one leading to the Coprophagous Lamellicorns, and the other to the Lignivorous ones, or Stag-beetles." (*Faun. Am. Bor.* p. 122.) The species of this family are widely distributed, inhabiting every quarter of the globe. Dejean gives about two hundred species in his *New Catalogue*, and there are about fifty inhabitants of our own country. From their general similarity of form and colours, their specific distinctions require minute examination. The situation and number of the striæ on the thorax and elytra, as well as the denticulations of the tibiæ, have been advantageously employed in this respect. The memoirs of Paykull, Drs. Leach and Erichson, are especially to be referred to; the last-named author divides the family into three groups, from the structure of the prosternum, the anterior part of which is either of the ordinary form, or simply advanced beneath the head, or furnished with an anterior lobe, which is similarly advanced; these groups are again subdivided by Erichson into twenty-one genera.

* The structure of the larva, it will also be observed, bears a much greater resemblance to that of the Necrophaga than it does to the Lamellicornes.

† Mr. Kirby has also indicated this relation (*Faun. Bor. A* p. 123.). Figures of the G. Trypanæus and of its trophi, will be found in Griffith's *An. K. Ins.* pl. 48. and 61.

The second division of the Chilognathomorpha corresponds with the LAMELLICORNES of Latreille, or the Linnæan genera Lucanus and Scarabæus, which are distinguished by having the antennæ, which are generally short, and 9 or 10-jointed, terminated by a large club, composed of several (generally three) of the apical joints, which are formed into elongated plates, which open like the leaves of a book, or of which the basal joint of the club is hollowed, so as to form a kind of cup, receiving the subsequent joints; in others, the terminal joints form a kind of comb. The legs are robust, the anterior tibiæ being generally dilated and toothed. The males are often distinguished by the singular horns with which the head and thorax are armed, or by the great size of the mandibles. This tribe of insects comprises the most bulky and gigantic of the beetle tribes; and hence, as well as from the great number of species, and the consequently important labours which they must perform in the creation, they have been selected by Linnæus and Fabricius as fit to be placed at the head of the present order. The majority of these insects, and especially the gigantic species, are inhabitants of tropical climates, comparatively few inhabiting our own country, although the Stag-beetle, Cockchafer, Rose-chafer, and the shardborne Beetle are amongst the largest, most interesting, or beautiful species of Coleoptera found in England. The larvæ are large fleshy grubs, having the extremity of the body curved towards the breast, so as not to enable the insect to creep upon a flat surface, but compelling it to lie on its side; the legs (six in number) are weak, the jaws strong, and the antennæ 4-jointed. These insects, in their larvæ and perfect states, are herbivorous, their habits, however, varying in the different families, according to their several structures.

The two Linnæan genera above named, Lucanus and Scarabæus, constitute the two primary groups into which the Lamellicornes are divisible, and to which Dumeril gave the sectional names*,

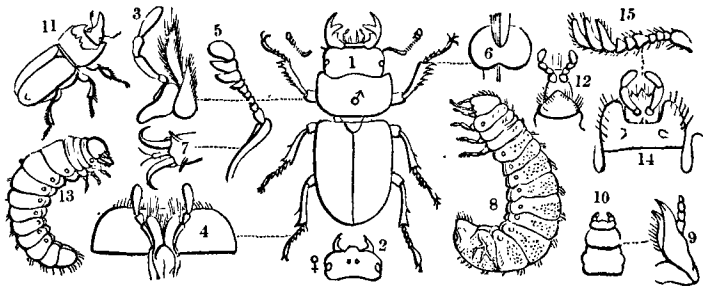
Priocera (Lucanus), club of antennæ serrated.

Petalocera (Scarabæus), club of antennæ lamellated.

* I should much prefer (notwithstanding the necessity for subdivision), in accordance with Mr. Kirby's plan, to retain for these two groups the Linnæan names, with the ordinary family termination in *idæ*.

The PRIOCERA *Dumeril*, or the family LUCANIDÆ * *Leach*, corresponding with the Linnæan genus Lucanus, and the Thalerophagous Recticera of MacLeay, is distinguished by having the antennæ strongly elbowed (*fig.* 18. 5.), generally 10-jointed, and

Fig. 18.



terminated with a pectinated, fissile, or subserrated club, and by the mandibles being very large and exserted, especially in the males. The

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body is of a solid consistence, of an oblong, oval, and depressed form (*fig.* 18. 1. Dorcus parallelipepidus ♂), with the head large, especially in the males (*fig.* 18. 2. head of the female of the same insect). The basal joint of the antennæ is very long, the following joint being inserted obliquely at its extremity, so as to form an angle or elbow. The eyes are often completely or partially divided on each side by the lateral and acute margin of the head (*fig.* 18. 6.). The immensely developed mandibles of the males in this family is one of its most striking features; these organs, in some instances (Chiasognathus, Pholidotus) equalling the entire length of the body. They are capable of biting with very great force. The maxillæ (*fig.* 18. 3.) are generally terminated by a narrow membranous and ciliated lobe; sometimes, however, they are corneous and dentate; the internal lobe is also often terminated by a small curved spine. The mouth is closed below by a large corneous plate, which Kirby and Spence hence regard as the lower lip (*labium*), but which, from a comparative examination of the lower parts of the mouth throughout the Lamellicorns, appears decidedly to be the analogue of the mentum; the parts which they regard as the tongue, and which are two small membranous threads, pencilled with hair, representing the true lip.* The figure 18. 4. represents the lower organs of the mouth *within*, the tips only of the labial palpi extending beyond the front margin of the mentum when the mouth is shut. It is at the base of these pencils of hairs, and within the large plate which closes the mouth, that the labial palpi, which are generally exserted, arise. The fore-legs are generally longer than the others, with the tibiæ toothed along the outer margin, those of the female being shorter and broader than in the males. The tarsi are cylindrical, and 5-jointed, with two strong terminal

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De Cervo volanti et ejus Hybernaculo, Epist. Itiner. 78. cent. i. p. 12. t. i. Wolfenbutt. 1739.

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And the general works of Fabricius, Olivier, Herbst, Jablonsky, &c.

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* See my observations upon the comparative structure of the mouth of Chiasognathus Grantii, *Mag. Nat. Hist.* No. 26.

claws, between which is a slender appendage, also terminated by two bristles (*fig.* 18. 7.). The elytra are large, and cover the entire abdomen.

These insects are found during the day upon the trunks of trees, old palings, &c., within which they have been bred. The males fly in the evening in search of their mates, which are more sluggish, seldom taking wing. The males appear to be much more numerous than the females, and violent contests take place between the former for the latter, during the period of their amours.* They live but a short time in the perfect state, perishing soon after coupling and depositing the eggs. The jaws were formerly employed in medicine, under the name of the horns of the Scarabæi. They were also, according to Pliny, suspended round the necks of children as amulets. The perfect insects feed, according to De Geer, on the honey-dew upon the leaves of the oak; they also feed upon the sap exuding from the wounds of trees, which they lap up with their finely ciliated maxillæ and lower lip. A difficulty appears to exist in some of the insects of this family (Chiasognathus), the mandibles being so much deflexed as to render it a matter of difficulty, if not impossibility, for these organs to come in contact with the food. Mr. G. Waterhouse has published some notes on a male Stag-beetle in the first part of the *Trans. Ent. Soc.* p. vi., which fed upon moistened sugar and raspberries, which last it wounded with its mandibles, previous to applying its maxillæ.

The females are said to use their mandibles, which are short, in forming a hole in the trunks of trees for the reception of their eggs. There are also some observations upon the habits of this insect recorded in the *Entomological Magazine*, No. 1. by Mr. Davis, and in the *Arboretum Britannicum* (Art. *Quercus*).

It would appear that, on certain occasions, these insects attack other softer-bodied species; Mr. Raddon having assured me that he once observed a Lucanus descending a tree with a caterpillar in its jaws; and M. Chevrolat communicated an observation to the Entomological Society of France (*Annales*, vol. iii. *App.* p. xi.), made upon L. parallelipepidus by himself, and which was caught in the act of biting a Helops caraboides for the purpose of sucking its fluid.

The transformations of the Stag-beetle have been long ago traced and figured by Rösel (*Ins. Belust.* vol. ii. pl. 4.), by whom also the sexual

* See Davis, in *Ent. Mag.* vol. i. p. 86.

distinctions (neglected by many subsequent writers, who considered the female as a distinct species which they named inermis) were exhibited. The eggs are of an oval form; the larva is long, thick, nearly cylindric, of a white colour, and fleshy consistence, the segments not being transversely impressed as in the Scarabæideous larvæ; the body being curved, so that the insect is compelled to lie upon its side; the head is horny, rust-coloured, and furnished with two powerful jaws, which it employs in gnawing the wood upon which it feeds, and which it reduces to a kind of tan; the antennæ are short. It has six reddish scaly articulated legs attached to the first three segments of the body; the terminal segment is entire and not so large as the preceding. When arrived at its full size it forms a cocoon, similar to those of the Prionidæ, formed of the minute chips or dust which it has gnawed. In this cocoon it undergoes its transformations to the pupa and perfect states*; the large horns of the male being in the former folded upon the breast and belly, protecting the antennæ and legs, the abdomen being terminated by two spines. It has been supposed that the larva of this insect, which chiefly lives in the willow and oak, remaining in that state several (six, according to Rösel) years, is the animal so much esteemed by the Romans as a delicacy, and named Cossus. The injury which they cause is often very considerable, boring not only into the solid wood but also into the roots of the tree. Rösel's figures have been copied by Herbst, *Natursyst.* (vols. iii. and iv.), and by Shaw in his *Zoology*. M. Blot has published some observations on the larva of L. Cervus in the *Mem. Soc. Linn. de Calvados.* vol i.; and it is also figured by Posselt in his *Beitrage zur Anat. der Insekt* (Friburg, 1804, pl. 2. f. i.), and by Albrecht in the *Mem. Acad. Nat. Cur.* Bonn, vol. vi. pl. 5. Elaborate descriptions and figures of the larvæ of two Javanese species of Lucanus, are given by M. De Haan in his memoir upon the larvæ of the Lamellicornes published in the *Nouvelles Ann. du Mus.* (vol. iv. p. 125.), wherein their chief differences from the other Lamellicorn larvæ (except those of Aphodius) are stated to consist in the body being destitute of the transverse foldings so conspicuous in the latter, the longitudinal form of the anus and the bilobed maxillæ. Other internal distinctions are also noticed.

The Rev. W. T. Bree has given an account of the larva of Dorcus

* It would appear from a communication made by M. Audouin to the Ent. Soc. of France (*Ann.* vol. ii. p. 71. App.), that the insect remains a considerable time in the cocoon after attaining the imago state.

parallelipepidus in his memoir upon that insect, published in the *Mag. Nat. Hist.* (No. 34.), and which resides both in the larva and imago state in company with Sinodendron cylindricum in rotten ash-trees. (See also *Gardener's Magazine*, No. 78. for additional particulars relative to these two insects.) Dr. Ratzeburg has also figured the former species in its different states (*Forst. Insecten*, vol. i. tab. 3. f. 19.), and my *fig.* 18. 8. is copied from his figure of the larva of D. paralellipepidus. *Fig.* 18. 9. represents the maxilla, and *fig.* 18. 10. the labium of the larva of an exotic species of Lucanus, copied from De Haan's work, above referred to.

According to Mad. Merian, the larva of the exotic Passalus interruptus (which she has figured in its various states, *Ins. Surin.* pl. 50.) feeds upon the Battata, and resembles a thick fleshy worm with a small scaly head, six legs, and the hinder extremity of the body slender; and in collections of unpublished drawings, by Abbott, of North American insects, in the possession of W. Swainson and W. Raddon, Esqs., I have observed representations of the transformations of another species of this genus, the larva resembling that of the Stag-beetle, but represented with only two pairs of legs. It is recorded to have been found in rotten wood. M. Perchéron has also given a figure of the larva of this genus in his *Monographie des Passales.*

I am indebted to Mr. Ingpen for specimens of the larva of Sinodendron cylindricum found in rotten oak, and which does not materially vary in structure from the larva of the Lucanus. My *fig.* 18. 11. represents the male perfect insect (which is remarkable for having the mandibles not exposed). *Fig.* 18. 12. represents its instrumenta labialia *, and *fig.* 18. 13. its larva.

The insects of this family are very interesting in respect to their relations with other groups, and which clearly prove that the succession of natural affinities does not exist in a continuous and linear series, since, if such were the case, it is evident that no animal could claim more than two relationships, namely, with those immediately preceding and following it. That the Lucanidæ are very nearly allied to the Scarabæidæ has never been denied, and their affinity with the Histeridæ has been proved by Mr. MacLeay. They have, however, other relations, which are equally strong with the latter, and which

* Mr. Curtis's figures of these parts, given in the *Horæ Entomologicæ*, and in the *Illustrations*, are at variance with each other, as well as with nature. The insect forms a remarkable exception in the family, from having the labium (or ligula) entirely exserted, and not concealed by a large basal mentum.

cannot be regarded merely as analogies. By means of Sinodendron Passalus* and Chiron, a relation is established with the Bostrichidæ, some of the exotic species of which have very much the appearance and habits of those Lucanidæ. Platycerus, also, from its peculiar form, is considered by Mr. MacLeay as osculant between this family and the Trogositidæ (especially resembling Temnoscheila *Westw.*, Trogosita ænea). In like manner the various points of relationship between several of the genera of Lucanidæ and Prionidæ, which I have detailed in the *Zool. Journ.* No. 18., and *Mag. Nat. Hist.* No. 26., are too numerous and important to be regarded merely as analogies. Mr. Kirby (*Faun. Bor. Am.*) has in like manner considered, that by passing from Lucanus through Cucujus, Pytho, and Trogosita, we arrive direct at the Longicornes, and from thence to the Eupoda *Latr.* and Chrysomelidæ.

This family is of moderate extent, and but sparingly scattered over the globe; very few species are found in this country, the greater portion being indeed extra-European, few exceeding our Stag-beetle in size. The genera Lamprima and Ryssonotus are confined to New Holland; Pholidotus, Chiasognathus, and Psalicerus to South America; Dorcus and Ægus chiefly to the Islands of the Indian Archipelago, whilst Passalus and Lucanus extend over every quarter of the globe.

The name Lucanus was first employed by Nigidius according to Pliny, to designate beetles with horns. Scopoli, however, in his *Entomol. Carniolica*, 1763, was the first modern author who applied the term to the Stag-beetles as generically distinct from Scarabæus; Geoffroy, in the following year, giving the name of Platycerus to the same insects. Scopoli's name was retained by Linnæus, but the French entomologists have, nevertheless, employed the name of Geoffroy for one of the minor divisions of the genus.

Mr. MacLeay has divided this section into five groups, to which he applied the term families; viz. Lamprimidæ, Æsalidæ, Syndesidæ, Passalidæ, and Lucanidæ. By regarding, however, as we have hitherto done, the Linnæan genera as of corresponding rank with the modern families, these groups must be regarded as sub-families; more-

* Mr. Kirby (*Faun. Bor. Amer.* published since this passage was written) has made a similar observation, describing a remarkable Colombian insect, Phrenaputes Bennettii (figured, with its trophi, in *Griff. An. Kingd. Ins.* pl. 50. and 69.), as affording a further step in this passage, which is supposed to lead directly to the Weevils; the last step in this passage seems, however, to me to be very doubtful.

over, they have not been adopted by subsequent authors, Latreille dividing the section into subdivisions, having the genera Lucanus and Passalus as their respective types, the latter having the antennæ scarcely elbowed (*fig.* 18. 15.), and the maxillæ corneous and toothed, as well as the labium (*fig.* 18. 14.). There are but four British species belonging to as many genera, all of which enter into MacLeay's family Lucanidæ.

Amongst the exotic genera, the beautiful Australian genus Lamprima, is distinguished by its splendid metallic colouring, the remarkable porrected and villose mandibles, and the large plate which arms the extremity of the anterior tibiæ of the males. Pholidotus is also metallic, but the body is clothed with pale buff scales, and the mandibles are very long; but the most remarkable genus in this respect is Chiasognathus (Steph. in *Trans. Phil. Soc., Cambr.*) in which these organs are longer than the body, rather slender, bent down towards the tip where they are suddenly reflexed; they are also furnished on the under side at the base with a long horn; the colours of this genus are exceedingly splendid and metallic. The only species Ch. Grantii inhabits the Island of Chiloe on the Western Coast of Colombia. The female, which has been shown to me by M. Audouin, is very different, having very short mandibles. Another genus Trictenotoma (*G. R. Gray*) is not less interesting, having the antennæ nearly as long as the body and not elbowed, with the three terminal joints but very slightly produced on the inside and the tarsi heteromerous. This insect, which I first noticed in the *Zool. Journ.*, Nos. 18 and 19., and figured in *Griffith's An. Kingd. Ins.* t. v., is of very difficult location, appearing, however, to connect the Lucanidæ and Longicorn beetles. It is from Java and the East Indies. This is the Rafflesian insect alluded to by Mr. Kirby in his *Fauna Boreali Americana*, p. 166., as forming this passage.

The PETALOCERA* of Dumeril (Scarabæus *Linnæus*), or second division of Lamellicorn insects, is a group of very great extent, distinguished

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from the Priocera by having the antennæ not elbowed, 8, 9, or 10-jointed, and terminated by a large mass, composed of several, generally three,

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plates, which shut and open like the leaves of a book: in some species these plates are flat, so as to be placed side by side (*fig.* 20. 18., 22. 8, 9.); but in others the outer plates are, or, at least, the basal one is, hollowed, forming a kind of box, enclosing the intermediate plate (*fig.* 20. 7. 1. 2. 3.); the mandibles, which are very variable in their structure, corresponding with the habits of the various groups, do not exhibit any striking sexual variations; but the head and thorax of the males, in some of the groups, are armed with strange horns or protuberances of the most diversified appearance, and of which it is very difficult to conceive the uses; the antennæ, also, in the same sex, are sometimes more developed than those of the females; these organs are inserted in cavities at the lateral margins of the head; the palpi are short and filiform; the mentum is large and horny (*fig.* 20. 5, 6., 22. 2. xx.), often covering the labium (or *ligula*), and sometimes preceded by a transverse piece (*fig.* 20. 5, 6., 22. 2. x.), which has been named by MacLeay the stipes, and by Strauss la pièce prébasilaire, but which does not constitute a distinct articulation, being only the front part of the jugulum (*fig.* 20. 5, 6. o.); although in some species, which appear to be destitute of a labium, which is internal, and of which the place is supplied externally by the mentum, the stipes is more fully developed, so as to appear to supply the place of the mentum, as in the Cockchafer (*fig.* 22. 2.); the body is generally more or less oval and convex, the legs robust, the anterior, and sometimes all, the tibiæ, generally toothed on the outside. In many of these insects, especially those which feed upon leaves, the internal edge of the mandibles is formed into a broad horny plate, with various transverse channels, well formed for masticating. This structure has been described by Knoch (*Neue Beitrage*, vol. i.), Olivier (*Entomol.* i. 6. 42.), and by Kirby (*Linn. Trans.* vol. 14.). (See my *fig.* 22. 5.)

Some singular monstrosities, occurring in various species of this family, have been recently described; namely, Rhisotrogus (*Ann. Soc.*

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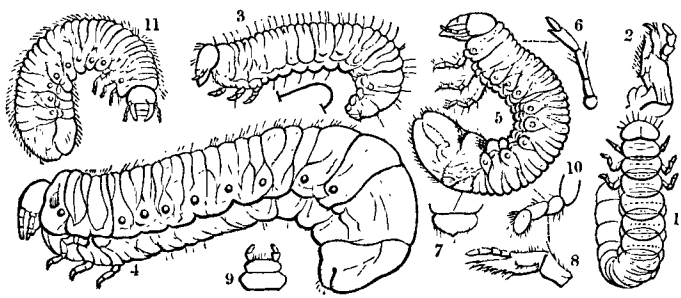
Olivier, Gyllenhall, Schonherr, Herbst, Jablonsky, &c.

Ent. de France, 1834), Rutela (in the same work, 1835), Melolontha (in the same work).

These insects are almost universally confined in their mode of living to vegetable substances; being, as Scopoli well described them, "scarabæi Floræ famuli;" a large portion of them subsisting upon decaying vegetables, whilst others feed, in the perfect state, upon leaves and flowers, their larvæ devouring the roots of grass, &c., and often causing great damage. In the colours of these insects, we find a conformation of their habits; thus, the species which frequent dung, and burrow under ground, are generally of black and obscure hues, whilst those which live upon leaves and flowers are generally gaily, and often splendidly, coloured: indeed, the Cetoniæ and some other groups vie with the Buprestidæ in this respect.

The larvæ are long fleshy grubs, of a soft fleshy consistence, and whitish colour, divided into fourteen segments (which are trans-

Fig. 19.



versely channelled), including the head; the extremity of the body is curved downwards and inwards, so that, in repose, the natural position of the insect is upon its side, like the Iuli. In creeping, however (which appears to be scarcely a natural effect, especially when we recollect the situations in which these larvæ reside), the body is extended in the ordinary position. The head is generally large and horny, convex in front, with the top curved; the eyes wanting; the antennæ 4 or 5-jointed (*fig.* 19. 6. antenna of the larva of the Cockchafer); the labium composed of two pieces, the basal one transverse, the other smaller and rounded, with two short palpi (*fig.* 19. 9.); the labrum transverse (*fig.* 19. 7.); the mandibles are strong, flat on the anterior surface, concave on the posterior, dilated at the base into a

molar tooth, with transverse ridges; the maxillæ (*fig.* 19. 8.) are attached to the labium in the same line, with a strong geniculation below the centre, and generally terminated by a single lobe; two, however, exist in the larvæ of Aphodius (*fig.* 19. 2.) and Trox. The maxillary palpi 3- or 4-, and the labial 2-jointed. The structure of the trophi of these larvæ offers considerable analogy with the parts of the mouth in the Orthoptera. The legs are robust, with four joints, terminated by a strong hook (*fig.* 19. 10. hind leg of the larva of the Cockchafer). The nine pairs of spiracles are placed upon the prothorax and eight basal segments of the abdomen. The anus is very large, transverse, or longitudinal. In their internal anatomy, the Petalocerous larvæ (excepting Aphodius) vary considerably from those of the Lucanidæ. Some of these larvæ are several years in attaining their full size; they then form, in situations where they reside, an oval cocoon, composed of earth, excrements, and morsels of gnawed wood, &c., agglutinated together. The pupæ are of the ordinary form; but the sheaths of the lower wings are rather longer than those of the elytra.

The larvæ of the Lamellicorn beetles have formed the subject of an elaborate memoir by M. De Haan, published in the *Nouvelles Annales du Muséum*, vol. iv., in which the external and internal structure of the following species has been very completely investigated; Oryctes nasicornis (*fig.* 19. 4.), O. Silenus, Dynastes (Scarabæus), Hercules, Dichotomus, ? Atlas, and Gideon, Cetonia ænea and aurata (*fig.* 19. 11.), Melolontha fullo and vulgaris (*fig.* 19. 5.), Trichius nobilis, Hoplia ? Aphodius nigripes (*fig.* 19. 1.) and conjugatus. The following sketch, confined to the external characters, and excluding the Lucanidæ, will show the distribution of these larvæ proposed by M. De Haan, in which there are four chief types of form: —

A. Maxillæ simple at the extremity.	
1. Head not so broad as the body.	
a. Anus ventral.	
α. Mandibles elongate.	Oryctes.
β. Mandibles dilated.	Scarabæus (Dynastes).
b. Anus terminal.	Cetonia.
2. Head as broad as the body.	
a. Anus bilobed.	Melolontha.
b. Anus trilobed.	
α. Superior lobe largest.	Trichius.
β. Superior lobe smallest.	Hoplia.
B. Maxillæ with two terminal lobes.	Aphodius.

The larva of Oryctes nasicornis (*fig.* 19. 4. after De Haan) has also

been very minutely examined by Swammerdam, both internally and externally (*Book of Nature*, pl. 27.), by whom the remarkable difference existing in the structure of the nervous system in the larva and imago states was discovered. Frisch, also (*Beschr., &c.*, vol. v. pl. 1. f. 1.), and Rösel (*Ins. Belust.* vol. ii. pl. 6. f. 3, 4.), have represented the larva and pupa of Oryctes nasicornis. The two last-named authors have also represented the transformations of Cetonia ænea; and M. Bouché has described and figured the larva of Cet. marmorata (*Naturg. de Ins.* t. 9. f. 1—6.); but the meso- and metathoracic segments are represented as furnished with spiracles, and the two terminal segments (thirteenth and fourteenth) are confounded together into a mass nearly half the size of the rest of the body. The larva of Cet. aurata (*fig.* 19. 11.) figured by De Haan, Ratzeburg (*Forst. Ins.* t. 3. f. 18.), and De Geer (vol. iv. pl. 11.) resides, as I am informed by Mr. Kirby, in ants' nests. That of Melolontha vulgaris (*fig.* 19. 5.) has also been figured by Gœdart (No. 111.), Rösel (vol. ii. pl. 1.), Kirby and Spence (*Introd.* vol. iii. pl. 17. *fig.* 12.), Suckow (*Naturg. des Maikafers*), Albin (pl. 60.), Ratzeburg (*Forst. Ins.* vi. t. iii. f. 1. B—E.), and in many other works. The larva of Trichius nobilis is figured by Rösel (vol. ii. pl. 3.): it was found in a rotten plum tree; but, according to Froriep (*Notiz.* vol. xiiil p. 321.) it feeds upon snails. The larva of Trich. eremita is given by Drumpalmann (*Naturh. beschr. Thurr. nord. Prov. Russl.*, Riga, 1811, pl. 11. f. 6.). Bouché has described the larva of Aphodius lividus (*Naturg.* p. 100.). The larva represented by Frisch (vol. i. p. 3. pl. 19.) as that of Aphodius is a Staphylinideous larva. The last-named author has also figured the transformations of Geotrupes stercorarius (vol. i. pl. 4. t. vi.), Anomola Frischii (ditto, t. xiv.) and Melolontha solstitialis (vol. ii. pt. 1. t. 15.) Germar has illustrated the transformations of Melolontha ruficornis in his *Mag. der Ent.* vol. i. p. 8. Bouché has also described the last-named insect and Anisoplia horticola and fruticola (*Naturg. Garten Ins.* p. 19—21.). Mr. G. R. Waterhouse has also described and figured the larva (*fig.* 19. 3.) and pupa of Trox arenarius, the former of which differs from the other Petalocerous larvæ (except Aphodius, *fig.* 19. 2.) in having the maxillæ bilobed; but the antennæ are described as only 3-jointed, whereas in Aphodius they are stated by De Haan to be 5-jointed.

The origin of the name Scarabæus appears doubtful; the word, indeed, never occurs but in the writings of Latin authors; yet Fabricius and Olivier give its derivation from the Greek σκάπτω; which

Mr. MacLeay doubts, considering it to be of Etruscan origin, adding, that it may have been obtained from the Greek σκαριφάομαι, the verb διασκαριφῆσαι being properly applied to the actions of animals which scratch or dig up the earth with their claws. Pliny* accordingly gave a particular description of the sacred beetle of the Egyptians under the name of Scarabæus; and, in later times, Linnæus applied it in a general manner to the whole of the Lamellicorn beetles, placing the gigantic cornuted species (Hercules, &c.) at the head of the genus. Geoffroy, considering that the dung-rolling beetles constituted a distinct genus, applied to them the name of Copris, although it is evident that in strictness the name of Scarabæus ought to have been retained for these, and another name given to the remainder of the Linnæan Scarabæi. Fabricius introduced still further confusion, giving Weber's name of Ateuchus to the sacred beetles, Geoffroy's name of Copris to some other dung-beetles, his own name of Geotrupes to the gigantic species (which do not burrow in the earth), and that of Scarabæus to the earth-boring shard-borne beetles (or modern Geotrupidæ.) Mr. MacLeay, however, endeavoured to remedy this confusion by restoring the name of Scarabæus to the Sacred beetle, and giving to the Scarabæus of Latreille (Geotrupes *Fab.*) the name of Dynastes. His names have not, however, been adopted abroad; and the consequence is that, even at the present day, the great Hercules beetle and its allies is generically named Dynastes by English, Scarabæus by French, and Geotrupes by German, entomologists. But few general observations upon the geographical distribution of these insects (and these suggested by Mr. MacLeay and Dr. Reich *Nova Acta Cæsar. Nat. Curios.* t. xvi. par. 2.) can be given. The tropical forms appear to extend much further north in America than in Europe; that is, in a manner directly the reverse of what takes place in plants. Thus, Copris carnifex *F.*, Cetonia nitida *F.*, Rutela 6-punctata *Latr.*, and other New York insects, bear a far greater resemblance to insects from tropical America, than species inhabiting the same latitude in Europe would bear to tropical Africa. Again, the Glaphyridæ have never as yet been found in the Old World, nor the Rutelidæ in the New. The Aphodiidæ seem most numerous in rather high latitudes; the Geotrupidæ in temperate, and the Scarabæi in tropical,

* Hist. Nat., xxx. 30. "Scarabæum qui pilulas volvit. Propter hunc Ægypti magna pars Scarabæos inter numina colit," as quoted by MacLeay.

climates. The Dynastidæ, Cetoniidæ, Anoplognathidæ, and Rutelidæ, are most numerous in the warmer climates; but the two first recede much further from the equator than the two last. The giant Dynastidæ are far more abundant, and of a larger size, in South America than in India. The tropical Coprophagous species are more numerous than the extra tropical, being in the proportion of 4 : 3; the services rendered in hot climates by these scavengers of nature requiring such an increase. The species of Onthophagus and allied genera are exceedingly numerous in East India. In like manner, Coprophaga in general, as compared with the remainder of the Saprophagous Petalocera are in the proportion of 3: 2.; but more recent discoveries have proved that the Coprophaga are still numerous, being in Dejean's new catalogue in the proportion, as compared with the remainder of the Linnæan Scarabæi, of 2: 3.

From the vast extent of this tribe of insects (there being nearly 2000 species indicated by Dejean), and from the great variation in their habits and structure, it is evident that their investigation must be accompanied by the establishment of a great number of divisions and subdivisions. The Linnæan distribution, founded upon the presence or absence of horns in the head and thorax, is as artificial as can well be imagined; the sexes of the same species varying in these respects. Scopoli, in his *Entomologia Carniolica*, introduced a more natural mode of arrangement, dividing the species into Anthophagi (flower-eaters) Phyllophagi (leaf-eaters), and Stercorei (dung-eaters); and the same mode of distribution was also followed by De Geer, who established three families: 1. Scarabées de terre; 2. Scarabées des arbres; 3. Scarabées des fleurs.* In the former arrangement, Oryctes and Trox were arranged with the Phyllophagous species, but in the latter the Dynastes were arranged in the first family. Various genera were subsequently established by Fabricius, Latreille, Olivier, Illiger, and others, as independent groups, but which Latreille brought together according to their affinities; adopting, in his earlier works, three families: Coprophagi, Geotrupini, and Scarabæides; which last comprised not only the "Scarabées des arbres" and "Scarabées des fleurs," but also a portion of the "Scarabées de terre." Mr. MacLeay, whose elaborate investigations of this group are published in the *Horæ Entomologicæ*, considers that the Linnæan Scarabæi branch into two co-

* Perty still more naturally divides the Scarabæi into three sections; those frequenting growing vegetables, putrescent vegetable matter, or dung-feeders.

lumns; one consisting of Saprophagous insects, or such as feed upon putrid or decomposed vegetable matter; and the other of Thalerophagous insects, or such as live upon green or fresh vegetable food; the former corresponding with De Geer's first, and the latter with his two other families. Each column also consists of two groups; the first composed of insects which have membranaceous maxillæ, and therefore live on juices, and, as it were, by licking their food; and the second of insects which have corneous or crustaceous maxillæ, and therefore live on a more solid species of food, and by mastication. The following is Mr. MacLeay's table of the Petalocera (*Horæ Ent.*, p. 25.).

Saprophaga.	Thalerophaga.
Scarabæi terrestres *De Geer.*	Scarabæi florales, Scarabæi arborei } *De Geer.*
Insecta materiis decompositis vel putrescentibus victitantia. Pedibus validis (posticis ab aliis subremotis), tibiis latis, elytris sæpiùs ad anum pertingentibus.	Insecta materiis vivis vel vigescentibus victitantia. Pedibus gracilioribus, tibiis subangustis, elytris rariùs ad anum pertingentibus.

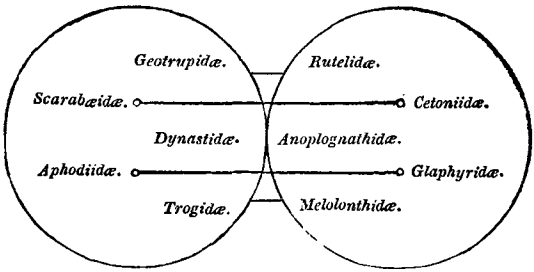
Character analogus.

Coprophaga, vel succis excretoriis victitantia.	*Geotrupidæ.*	Mandibulæ porrectæ corneæ.	*Rutelidæ.**	*Anthobia*, florum vel arborum succis victitantia.
	Scarabæidæ.	Mandibulæ membranaceæ.	*Cetoniidæ.*	
	Aphodiidæ.	Maxillæ processu membranaceo.	*Glaphyridæ*	
Xerophaga, vel materiis sicioribus victitantia.	*Trogidæ.*	Maxillæ dentatæ; mandibulæ acutiusculæ laniatores.	*Melolonthidæ.*	*Phyllophaga*, vel folia mandibulis rodentia.
	Dynastidæ.	Maxillæ dentatæ, vel inermes, mandibulæ obtusæ, molares vel incisoriæ.	*Anoplognathidæ.*	

Besides the analogous character afforded by the structure of the mouth, the opposite families in each group have a striking similarity to each other in general form, although their analogics can only be gathered from the most general view that can be taken of the different groups. But the most remarkable of Mr. MacLeay's views was, that each of these two columns is capable of forming a circle; the Geotrupidæ being connected with the Dynastidæ by Orphnus and Oryctes, and the Rutelidæ with the Anoplognathidæ, by means of

* The recently observed habits of this family clearly prove that it ought to be inserted amongst the Phyllophaga. See *post.*

Pelidnota and Areoda; the two circles touching one another at the families Dynastidæ and Anoplognathidæ, which are intimately connected, by means of Dasygnathus and Amblyterus, in the following manner: —



These ten families are well represented by the ten following species: — Geotrupes stercorarius, Scarabæus sacer, Aphodius Fossor, Trox sabulosus, Oryctes nasicornis, Rutela lineola, Cetonia aurata, Amphicoma hirta, Melolontha brunnea, and Anoplognathus; and Mr. MacLeay has taken this occasion to observe how necessary to the entomologist is the study of exotic insects, as five of the above-named species do not inhabit this country. Latreille, profiting by the researches of Mr. MacLeay, considerably modified his former views, distributing the Petalocera, for which he advantageously retained the name of Scarabæides, in the following manner, in his *Familles Naturelles*: —

I. *Coprophagi.* — Antennæ 8 or 9-jointed; labrum, mandibles, and maxillæ, membranous. [Aphodiidæ and Scarabæidæ.]

II. Antennæ 10 or 11-jointed.

1. Mandibles corneous.

A. *Arenicolæ.* — Mandibles and labrum exposed; anus covered by the elytra. [Geotrupidæ and Trogidæ.]

B. Mandibles and labrum concealed; anus uncovered.

a. Labium concealed by the mentum.

* *Xylophili.* — Antennæ 10-jointed; mandibles laterally exposed; maxillæ various. [Dynastidæ and Rutelidæ.]

** *Phyllophagi.* — Antennæ 8 to 10-jointed; mandibles hidden by the clypeus and maxillæ; club of antennæ sometimes 7 or 5-jointed. [Anoplognathidæ and Melolonthidæ.]

b. Anthobii. — Labium produced; mandibles corneous; maxillary lobe membranous. [Glaphyridæ.]

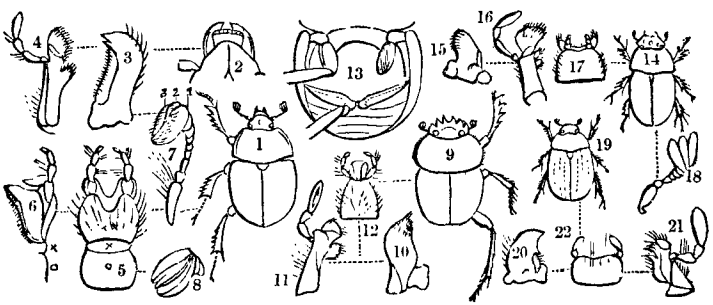
2. *Melitophili.* — Mandibles membranous. [Cetoniidæ.]

Here we find a portion only of the ground Scarabæi regarded as forming a section of equivalent rank with the entire remainder of the

Petalocera, which must be clearly unnatural; whilst, on the other hand, if we look at the groups *per se*, and as of equal rank, we find the Xylophili composed of a most heterogeneous assemblage. I shall therefore adopt the groups proposed by Mr. MacLeay, observing only that they appear to be of equivalent rank with the divisions of the Carabidæ, and which it would be more convenient (in order to retain the Linnæan name Scarabæus, in its Linnæan extent) to regard as subfamilies, in the same manner as I have dealt with the Brachinides, &c.

The first of Mr. MacLeay's families, GEOTRUPIDÆ, is distinguished by the membranaceous structure of the maxillary lobes (*fig.* 20. 4.),

Fig. 20.



by the porrected, curved, and horny mandibles (*fig.* 20. 2. and 20. 3.), the elytra rounded behind, and entirely covering the abdomen; the tibiæ broad and toothed; the labrum exposed (*fig.* 20. 2.), as well as the labium, which is bilobed (*fig.* 20. 5. and 20. 6.); the fleshy tongue, large and internal (*fig.* 20. 6.); antennæ 10 or 11-jointed, the club large, subglobose, and 3-jointed, the middle joint of the club encased in the preceding (*fig.* 20. 7, 8.); the body short, thick, and convex, generally of a black colour (*fig.* 20. 1. Geotrupes vernalis); the elytra smooth, or simply striated; the males, in some species, are furnished with horns, or other sexual peculiarities; the thorax is broader than long; the scutellum generally distinct.

These insects perform an important part in the economy of nature, by feeding upon and burrowing under newly fallen dung; thus not only diminishing the quantity of excrementitious matter, by devouring it, but also contributing to its dissemination in the earth, by the burrows

which they make. Such are especially the habits of the typical species of which our English shard-borne beetle (Scarabæus stercorarius *Linn.*) may be cited as one of the best known examples.

Commentators have been at variance respecting the name of this insect*; some considering that it ought to be named the shard-*born* (that is, born in shard, or dung) beetle; and others, that the name should be written shard-*borne* (that is, borne, during flight, upon its shards, or scaly wing-covers).

Some of the extreme genera of the family are said to feed upon roots, and may often be considered as even lignivorous. They fly after sunset, and in the twilight, and counterfeit death, when alarmed, in a manner quite unlike that practised by the Byrrhidæ, &c.; namely, by rigidly extending the legs.

The New Holland genus Elephastomus *MacL.* is distinguished by having the clypeus produced in front into a long and narrow deflexed horn; furnished, on its under surface, near the base, with a second and shorter perpendicular horn, immediately in front of, and extending far below, the mouth.

The Brazilian Hybosori frequent human excrement, without, however, burying themselves in it. The Athyrei and Odontæi resemble the Coprides in their habits, although some of the latter are found in grass and rotten wood (Perty, *Del. An., art. Braz.*, and Lacordaire).

The genus Lethrus *Scop.* consists of several curious species, inhabiting the south-eastern parts of Europe; having the club of the antennæ triangular, the two terminal joints being concealed within the extremity of the basal joint of the club; the mandibles are very large, and furnished with a strong horn on the under side. They burrow in the ground, and do great mischief by gnawing off the young shoots of the vines, upon which they feed. Each burrow is inhabited by a pair; and violent battles sometimes occur between the male and an intruder of its own sex. (Fischer, *Ent. Russ.* v. i.)

The insects of this family are chiefly inhabitants of moderate climates; the numbers found in the temperate zone, as compared with those from the tropics, and from latitudes higher than 60°, being in the proportions of 10, 2, 1; the greater number of known species being found in Russia, Siberia, Central Europe, and North America. The

* See Heineken, in *Zool. Journ.*, No. 18. p. 197.; Kirby and Spence, vol. i. p. 392.; *Brit. Cyclopæd.* vol. ii. art. Geotrupidæ; and Patterson's *Letters.*

only species of Geotrupes found in the other parts of Asia is one brought from the Himalaya Mountains by J. F. Royle, Esq., and figured in his work upon the botany and natural history of that region.

The Geotrupidæ are distinguished from the Scarabæidæ and Aphodiidæ by their robust horny mandibles, and from the Trogidæ and Dynastidæ by the membranaceous lobes of the maxillæ. They are generally of a moderate size, when compared with some of the other Saprophaga, although the typical species found in this country may be considered as sufficiently conspicuous.

The species of Geotrupes (respecting the number and variations of which considerable differences of opinion exist) are distinguished by the splendid metallic tints with which the under side of the body is adorned. The Bolboceri are of small size: they have been found, according to M. Le Vaillant, in considerable numbers in the stomachs of frogs and toads. They fly in the twilight.

The second family, SCARABÆIDÆ, as restricted by Mr. MacLeay, is an extensive and important group, distinguished by the large, advanced, and generally notched clypeus, which conceals not only the membranous labrum, but also the mandibles, which are corneous at the base, but terminating in a long, lanceolate, compressed, membranaceous plate (*fig.* 20. 10.), having its internal margin and apex ciliated; the antennæ are 8 or 9-jointed, with a 3-jointed club; the body is generally broad and depressed (*fig.* 20. 9. Scarabæus (Heliocantharus) puncticollis, from the south of Europe); the legs are long, the intermediate legs being inserted more widely apart than the others, and having the coxæ elongated, and more or less longitudinal, causing the metasternum to appear as a wide plate between the base of these legs (*fig.* 20. 13. underside of meso and metathorax and abdomen of Chalconotus cupreus); the posterior legs are also placed far back, so that the abdomen is reduced to a small size; the maxillæ are terminated by two membranous lobes (*fig.* 20. 11.); the labial palpi are very pilose, with the last joint much smaller than the preceding (*fig.* 20. 12.); the scutellum is not exposed; the elytra are generally somewhat square behind, exposing the extremity of the abdomen; the anterior tarsi, in some species, are entirely wanting *; the claws are minute; the anterior tibiæ are externally 3-dentate, with a

* See Brullé in *Ann. Scienc. Nat.*, 1837.

single spur; the intermediate tibiæ have one or two calcaria, whilst the posterior have but one.

These insects compose a very numerous group of dung-feeding Lamellicorns, of which, however, the majority are inhabitants of tropical countries*, few only being found in our island, and those but of small size. Some of the tropical species, as the metallic Coprides, are amongst the most bulky species of beetles. The species are generally of a black hue; but amongst them are to be found some (especially the Phanæi, many Coprobii, Onthophagi, &c.) adorned with the richest metallic colours.

From the great similarity in the structure of the mouth of all these insects, a great uniformity of habits is evident. But a more remarkable peculiarity exists in the structure and situation of the hind legs, which are placed so near the extremity of the body, and so far from each other, as to give the insect a most extraordinary appearance whilst walking. This peculiar formation is, nevertheless (as Mr. MacLeay well observes), particularly serviceable to its possessors in rolling the balls of excrementitious matter in which they enclose their eggs; whence these insects were named by the first naturalists Pilulariæ. These balls are at first irregular and soft, but, by degrees, and during the process of rolling along, become rounded and harder: they are propelled by means of the hind legs; and the insects occasionally mount to the top, when they find a difficulty in urging them along; probably in order to destroy the equilibrium. Sometimes these balls are an inch and a half or two inches in diameter; and in rolling them along the beetles stand almost upon their heads, with their heads turned from the balls. These manœuvres have for their object the burying of the balls in holes, which the insects have previously dug for their reception; and it is upon the dung, thus deposited, that the larvæ, when hatched, feed. It does not appear that these beetles have the instinct to distinguish their own balls, as they will seize upon those belonging to another, in case they have lost their own; and, indeed, it is said that several of them occasionally assist in rolling the same ball. The males, as well as the females (of Gymnopleurus pilularius, at least), assist in rolling the pellets. They fly during the hottest part of the day. (See Dysderi, in *Trans. Soc. Turin.* vol. iii., *Ent. Mag.* vol. ii.

* Mr. MacLeay stated the proportions which the tropical Scarabæidæ bear to those from without the tropics to be nearly as 5 : 1. The former number has, however, been greatly increased of late years.

p. 187., Buckingham, *Voy. in Mesopotamia*, vol. ii. p. 410., *Mag. Nat. Hist.* No. 27., *Literary Gazette*, 1829, p. 686., Ionicus, in *Ent. Mag.* iii. 377., Sells, *Ent. Trans.* 2. p. xxiv.)

M. Westermann has observed (*Silberm. Revue Ent.* No. 3.) the habits of Pachysoma Æsculapius (Cape G. H.), which does not roll balls like the Sacred beetles and Gymnopleuri, but carries and buries pieces of dried dung, by the help of its hind legs, which are pressed against the body. These legs are differently formed in this insect and in Scarabæus; thus proving the correctness of Mr. Kirby's remark, that the hind legs in the latter were analogous to the fore legs in Onites. The North American Scar. volvens, which, as the name implies, is a ball-roller, is, however, a Coprobius, with the hind legs slender; but the tarsi are terminal.

Colonel Sykes has published some interesting observations on the Economy of the Indian Copris Midas, and the globular balls of earth and sand in which the pupa is enclosed. (*Trans. Entom. Soc. Lond.* vol. i. p. 130.) I have been indebted to W. Sells, Esq., for the somewhat similar cells of Copris lunaris.

"The Sisyphus Schœfferi also rolls pellets. I could not discover the use of its long hind legs." (Ionicus, in *Ent. Mag.*) It is curious that this writer should have noticed this fact immediately in connection with the proceedings of the Gymnopleurus and Scarabæus (which use their hind legs in rolling their pellets), and not have said in what manner the pellets are propelled by the Sisyphus.

The Brazilian Anamnesis Macleayii *Vigors* is found, according to Perty, in carcases in the month of October. The Hybomæ frequent dung, but do not burrow. H. erythroptera, however, is found amongst leaves, running quickly, and flying in the hottest part of the day. Coprobius castanopterus is also a constant flier, and is found in rotten wood. The brilliantly coloured Brazilian Coprobii are found both in dung and amongst the leaves, and not uncommonly congregated round the flowing wounds of trees; others frequent dung alone, but do not burrow (except C. carbonarius). The Eurysterni are similar in their habits to these last. The Coprides and Phanæi dig deep and oblique burrows, frequenting dung alone, and make a creaking noise, by rubbing the abdomen against the tips of the elytra. Ph. melon *Dej.* is, however, found under dead fish, and has a strong scent of musk; and Ph. nigro-violaceus, and sulcatus dig holes beneath, and bury, dead colubers in a few hours. The Brazilian Onthophagi are similar in

their habits to the European species; some, however, frequent the flowing wounds of trees, as, indeed, is occasionally the case with the European Onthophagus ovatus (Perty, *Delect. Animal., art. Braz.* p. 9, 10., and Lacordaire).

The type of this family is the renowned "Sacred beetle" of the Egyptians, of which so many models, carvings, amulets, &c., are discovered, occasionally of a gigantic size, in sarcophagi, and rolled up in the mummies and other ancient relics of that remarkable people, by whom its appearance in great numbers on the sandy margins of the Nile, after the annual rising and falling of the river, together with its extraordinary motions whilst rolling along its little globular balls of dung, were regarded as mystically representing the resurrection of the soul, the motions of the earth and sun, &c. Latreille, who has published a memoir upon these Sacred beetles in the fifth volume of the *Mém. du Muséum*, translated by Bennett, in the first volume of the *Zoological Journal*, and in the Appendix to the *Voyage to Meroe* of M. Caillaud, considers the species which he has named Ateuchus Ægyptiorum, and which is of a fine greenish colour, as that which especially engaged the attention of the early Egyptians, being found by M. Caillaud in Sennâri, where their first settlements were established.* Mouffet, with his usual cumbrous loquacity, has given a long account of these insects and their supposed virtues. It was also regarded as the emblem of fertility; and, even at the present day, we are informed by Dr. Clarke that it is eaten by the women of Egypt. The various species of Sacred beetles, whereof Dejean enumerates twenty-six, are distinguished by their flattened form, radiated clypeus, long hind legs, clothed with hairs, with the posterior tarsi obliquely inserted; head and thorax unarmed, and elytra, with the margins not sinuated, constituting the genus Ateuchus *Weber*, or the subgenus Heliocantharus *MacLeay*; the latter name being adopted from the Greek Ἡλιοκανθαρος, being the term given to these celebrated insects by the early naturalists. This family is nearly allied, on the one hand, to the Aphodiidæ (with which, indeed, Latreille united it, under the name Coprophagi), from which, however, it is distinguished by the broad, orbiculate form of the body, the elongated mandibles, and the large metasternum. From the Geotrupidæ they are easily distinguished by the large size of the head, the clypeus entirely covering

* See also the *Naturalist's Library*, art. Entomol., vol. ii. p. 188.

the parts of the mouth, and by the membranous mandibles. There are only two British genera (Copris and Onthophagus), of which the species are found in the spring, especially frequenting cow-dung. I have communicated a memoir, comprising observations on this family, and the description of some remarkable exotic forms, to the Zoological Society of London, and which is published in the last part of the *Transactions* of that Society.

The third family, APHODIIDÆ *MacLeay*, comprises those Coprophagous species which have the body of an oblong or oval shape, rounded at the extremity, with the abdomen entirely concealed by the elytra (*fig.* 20. 14. Aphodius Fossor); the legs placed at equal distances from each other; the mandibles short, dilated, and coriaceous (*fig.* 20. 15.); the scutellum is distinct and exposed; the labial palpi are glabrous, with the third and last joints often larger or longer than the preceding (*fig.* 20. 17.); the clypeus is entire, and never dentate, occasionally tubercular; and the maxillæ are terminated by two membranous lobes (*fig.* 20. 16.); the antennæ are 9-jointed (*fig.* 20. 18.). These insects are nearly allied to the Scarabæidæ, both in their antennæ, organs of the mouth, and legs; the sexual differences are, however, less decided, the head never being armed with horns. The chief difference between the two families consists in the more elongated form of the body, the ordinary sized metasternum, and the developed scutellum in the Aphodiidæ.

The species of this family are amongst the most minute of Lamellicorn beetles. They are far more abundant in this country than any other Petalocera, especially during the spring months, swarming in the dung of the larger herbivorous animals, or hovering over it as soon as it is dropped. Their metropolis appears to be in the temperate zones of the northern hemisphere, in which the proportion of species, as compared to the tropical species, is stated by Mr. MacLeay as at 8 : 1; appearing to replace with us the want of the Scarabæidæ. Dejean gives a list of one hundred and fifty-two species of Aphodius, from various quarters of the world, including the Cape, Madagascar, California, and the Mauritius. None, however, have been received, either by him or by Mr. MacLeay, from New Holland*; a peculiarity

* I have received two species from Van Diemen's Land, collected by R. H. Lewis, Esq.; and the Rev. F. W. Hope has others.

in entomological geography dependent, as Mr. MacLeay observes, upon the want in the Australasian continent of all large herbivorous Mammalia, except of the marsupial kind. Some of the species feed upon vegetable matter in a decaying state, especially such as are found upon the sea coast (Psammodius), and in which the maxillæ are of a more horny consistence, thus leading naturally to the following family.

From the Geotrupidæ and Trogidæ these insects are distinguished by the structure of the mandibles, which, together with the labrum, are concealed beneath the large produced clypeus, and the short glabrous palpi.

The fourth family, TROGIDÆ of MacLeay, is a family of but moderate extent, although very generally dispersed over the surface of the globe (*fig.* 20. 19. Trox sabulosus); and is distinguished by having the labrum coriaceous, and exserted; the antennæ 9 or 10-jointed; the club 3-jointed, the lamellæ being apart; the labium is entirely concealed by the mentum (*fig.* 20. 22.); the mandibles are horny, and sometimes toothed (*fig.* 20. 20.); the maxillæ are terminated by two lobes, often corneous and toothed (*fig.* 20. 21.); the body is ovate and gibbose, the elytra being inflexed at the sides; the scutellum is distinct, and the anterior tibiæ are often but imperfectly toothed on the outside; the head is deflexed; the thorax short, and transverse, posteriorly sinuated, with the anterior angles advanced. Some of the species are destitute of wings,—a peculiarity not observed in any other of the Linnæan Scarabæi; the elytra are very rugose, and often clothed with patches of short thick hairs or scales.

This family is related to the Geotrupidæ (with which Latreille has, indeed, united it, under the name of Arenicoli), in the exserted labrum and horny jaws; as well as to the Aphodiidæ, as above noticed. From these groups, however, they are sufficiently removed both in their structure and habits. They also bear a certain resemblance to some of the Histeridæ.

These insects produce a creaking kind of noise by alternately rubbing the anterior part of the mesothorax against the prothoracic cavity, or more probably the extremity of the abdomen against the elytra. They also possess the habit of counterfeiting death when alarmed, in the same manner as the Histeridæ.

The habits of the insects of this family have not been very satisfactorily recorded. If, indeed, as Mr. MacLeay notices, the observations of the more modern entomologists are altogether to be relied upon, their economy differs very materially from that of the other Petalocera. Thus Olivier observes of the European species of Trox, that they are met with on the ground in fields and sandy dry places, and that they are sometimes observed on dried animal substances, occupied in gnawing the cartilaginous parts which serve as the last connection for the bones of carcases, from off which the flesh has been long devoured or consumed; and this last observation is partially confirmed by Latreille and Kirby. Mr. MacLeay, however, says that nothing can strictly be said to have been determined with respect to the manners of the Troges, except that these insects are attracted to dried bones. Pallas discovered a species, which he names Scarab. silphoides, in the arid deserts of Tartary, in company with Hister and Dermestes, under dried carcases; whilst Acrel, according to De Geer, found Trox luridus (Scarab. à tubercules *De G.*) in rotten wood. Mr. Dillwyn records the capture of Tr. arenosus in carrion. Mr. Curtis states, that Tr. sabulosus has been found in abundance in a dead rook, and also beneath a dead animal, whilst the Rev. L. Jenyns captured a pair of Tr. scaber in decayed wood at Bottisham. In the *Règne Animal,* it is stated by Latreille, that they inhabit sandy districts, or reside under ground, appearing to eat the roots of vegetables. Trox sabulosus flies in the sunshine; and Perty states that the Brazilian species frequent carcases, devouring the tendinous parts, or are found in the excrement of man or herbivorous mammalia.

Messrs. Waterhouse and Pickering found Trox arenarius in great profusion in a quantity of rubbish in Battersea Fields apparently resembling the cuttings of felt.

The genus Ægialia is found upon the sea coast, where Mr. MacLeay conjectures, that it feeds in company with the Psammodii, upon putrid sea-weed or other marine detritus. From the apterous structure of Trox (Phoberus) horridus, Mr. MacLeay is induced to suppose, that it does not feed upon dried cadaverous substances, "because all insects, intended to live on animal matter, partially dispersed and collected in masses, are furnished with wings, in order to convey them the more rapidly to the objects pointed out by their instinct;" and therefore, that the apterous Phoberus, like Pimelia, Brachycerus, &c.

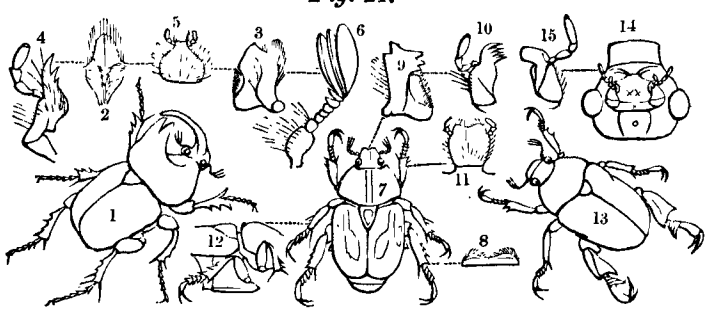
feed upon matter universally and generally spread over desert plains, whereby rapid and distant change of place is rendered necessary. The American Acanthocerus æneus *MacL.* frequents flowers in May, whilst A. MacLeayi *Perty*, is found throughout the year in rotten wood. (Perty, *Del. An. Art. Braz. Præf.*)

Mr. Curtis has noticed an interesting peculiarity in the structure of the mandibles, which are furnished with a deep rounded notch on the inside, covered by a leathery lobe, a structure which also prevails in many of the sand Heteromera, thus confirming the above-mentioned observation of Mr. MacLeay.

The Heteromerous genus Trachyscelis has no real affinity with this family: Mr. Stephens's mutilated individual (from an inspection of which he was induced to place this genus in this situation) not being a Trachyscelis. The British species of this family are very few in number.

The fifth family DYNASTIDÆ *MacLeay*, comprises an extensive series of gigantic insects, with which Linnæus commenced the classification of the Beetles, the males of which are pre-eminently distinguished by various singular protuberances, horns or tubercles, arising from the head or thorax, and often from both of these parts of the body (*fig.* 21. 1. Dynastes abderus *Sturm*, from Brazil),

Fig. 21.



occasionally giving to the insect a very extraordinary appearance, and of which the females are destitute; the clypeus is small, triangular, pointed in front, or terminated by two small obtuse teeth; the labrum (*fig.* 21. 2. labrum of Xylorictes satyrus) is a broad membranaceous plate, entirely concealed by the clypeus; the jaws are very

robust and horny (*fig.* 21. 3.), furnished with one or two obtuse teeth; the maxillæ are either terminated by a coriaceous ciliated lobe, or by an elongated corneous piece, having one or several acute teeth on its inside (*fig.* 21. 4.); the mentum (*fig.* 21. 5.) is large, concealing the labium, and of an ovoid or triangular form, truncated in front; the prosternum is not produced behind into a lobe; the tarsal claws are of equal size, and the scutellum is distinct; the elytra do not entirely cover the extremity of the abdomen; the antennæ are 10-jointed (*fig.* 21. 6.) with the club 3-jointed; the central lamella not being enclosed within the two external ones.

The colours of these insects are generally of a dark rich brown or chesnut colour.

Latreille has divided this family into two groups, from the unarmed or toothed structure of the maxillæ; but the dissection of a very few species of Oryctes and Dynastes will convince any one that the two groups are so gradually blended together that other characters must be resorted to.

The Dynastidæ reside either in rich vegetable mould, or in the putrid detritus resulting from the decomposition of trees. According to Humboldt, however, Geotrupes Ægeon is found in Chili upon cowdung.

The common continental species, Oryctes nasicornis, a reputed native of this country, is found in the larva state (*fig.* 19. 4.) in tanpits; and De Geer mentions that, in shifting a dung heap at Stockholm, which had long remained in the same spot, he dug out a vast number of the larvæ of this insect, as well as specimens of the imago. The eggs are oblong, about the size of a grain of hemp-seed, and of a yellow colour; the larva continues in that state four or five years, and then encloses itself in an oval and very smooth cocoon; the pupa lies upon its back, and the imago remains in its cell a month after it has attained the perfect state.

Mr. MacLeay has made various interesting observations upon the structure of some of these insects, with a view to the discovery of their various habits. M. Lacordaire, however, who has carefully described the habits of the Coleoptera of Guiana, states that they are much alike in this respect, concealing themselves during the day in holes dug in the earth, or in the decomposed trunks of trees, or running about the footpaths in woods; on the approach of night they leave their retreats and fly around the trees to a considerable

height with a loud humming noise, for the purpose, as M. Lacordaire supposes, of seeking food; but, as I should rather judge, from analogy with the proceedings of our Melolontha, in search of their mates. In the morning they are sometimes found under the leaves, or sticking to the branches: and Say records, that a great number of specimens of Dynastes Tityus were found in a cavity in an old cherry-tree near Philadelphia, which was blown down by the wind (*Amer. Ent.* vol. i.). Dynastes bilobus is found during the winter in ants' nests. (Perty.)

Lherminier states that the giant species, D. Hercules, saws off the branches of trees in Guadeloupe, and that its larva resides in rotten wood. It is attracted by the mucilaginous substance which exudes from the Sapium aucuparium, when wounded. (*Ann. Soc. Ent. France*, 1837, p. 503.)

The Phileuri burrow into the rotten trunks of trees in Brazil, and but rarely fly in the twilight. Some of the species devour half-dried carcases, and others are found under moist bark.

It would be an almost endless task to detail the variations exhibited by the horns and other grotesque protuberances with which the males of many species are armed. It must be borne in mind, however, that these horns are immovable portions of the horny skeleton, and offer no real analogy with the horns of the mammalia; although it is interesting, in respect to the analogies existing in remote tribes of the animal kingdom, that the quadrupeds which are cornuted are herbivorous, and as comparatively harmless as the Dynastidæ. It is also a curious circumstance that in the Dynastes (Hoplites *Dej.*) Pan, the females are cornuted as well as the males. One of the most singular species is the Macropus longimanus, in which the anterior femora are twisted and dentate, and the tibiæ very long and curved. Another interesting group from Mexico and Chili has been separated from Dynastes by Mr. Hope, under the name of Golofa, in which the head and thorax are armed with upright horns, and the anterior tarsi of the males very long, and articulated in such a manner that they cannot be extended except in a curved line.

The metropolis of the Dynastidæ is evidently within the tropical zone, six or eight species being only found in Europe; the proportion of tropical species, as compared with extra tropical, being, according to Mr. MacLeay, as eight to one.

From the Trogidæ these insects are at once distinguished by their arge size and concealed labrum; but the characters which separate

the extensive families of Dynastidæ, Anoplognathidæ, and Rutelidæ are sometimes very slight, consisting either in the concealed labrum, the transverse section of the clypeus, or the anteriorly porrected mesosternum.

Mr. Hope's *Coleopterist's Manual* must be consulted for various new genera separated from the typical genus. The two or three species of this family recorded to have been found in this country, were probably imported, as it is not likely such large insects would have escaped the observation of our numerous collectors, had they been real inhabitants.

The sixth family RUTELIDÆ consists entirely of exotic, and, for the most part, brilliantly coloured insects, of a moderate size, having the body of an ovate, subconvex or depressed form, and shorter and more rounded than in the Dynastidæ, from which they also differ in wanting the remarkable horns which arm the males of the latter family (*fig.* 21. 7. Rutela lineola from Brazil.) The antennæ are 10-jointed; the club 3-jointed; the labrum is exserted with the anterior margin, coriaceous (*fig.* 21. 8.); the mandibles are short and horny, and more or less exserted with a notch on the outer margin near the tip *fig.* 21 9.); the maxillæ are also horny and truncate, and with five or six teeth at the tip, with the inside sometimes membranous (*fig.* 21. 10.); the labium is concealed by the mentum (*fig.* 21. 11.); the elytra do not conceal the extremity of the abdomen; the thorax is transverse-quadrate; the scutellum is large and distinct; the mesosternum is anteriorly produced between the base of the middle legs (*fig.* 21. 12.); the legs are robust, with the posterior femora sometimes greatly thickened; the claws of the tarsi are generally unequal in size, and occasionally divided. The clypeus commonly exhibits a transverse section, dividing it, as it were, into two parts before the eyes.

The curious genus Hexodon, serving to connect this family with the preceding, but respecting whose country and habits naturalists have been in doubt, has recently been discovered in considerable numbers by M. Luczot in Madagascar upon the sand, and not upon leaves as stated by Latreille. A new species of this genus has been described by Mr. Hope under the name of H. Kirbii (H.

Hopei, *Kollar.*) With the exception of a very few species, these insects are exclusively confined to the tropical regions of the New World. Out of eighty species belonging to Mr. MacLeay, only two or three are extra tropical, and none from higher lattitudes than 40°. The Brazilian Cyclocephalæ are abundantly found in flowers, C. melanocephala frequenting those of the Datura arborea in the month of December; they also fly round the trees in the evening, and hide themselves beneath the roots by day. The Areodæ and Pelidnotæ are found upon leaves and flowers. P. micans frequents the flowers of Geonoma, a genus of Palms, in the month of December (i. e. the middle of the Brazilian summer.) The species of Macraspis are found in the morning upon the leaves, and fly by day round the trees with a humming noise, and gnawing the flowers. The Rutelæ are similar in their habits, often appearing in vast numbers.

The singular southern European genus Cælodera (Pachypus *Latr.*) is remarkable for the anomalous nature of the female, which is of a large size, with the abdomen greatly swollen, and which has been described as destitute of organs of flight (Feisthamel, in *Ann. Soc. Ent. Fr.* 1837, p. 260.). M. V. Audouin has, however, exhibited to me his dissections of this insect, in which he has discovered the rudiments of the elytra concealed beneath the prothorax.

Two of the most remarkable species in this family are the Chrysophora chrysochlora *Latr.*, a splendid golden-coloured insect, discovered in Peru by Humboldt, having the hind legs of the males of a very great size, and the posterior tibiæ produced into a strong spine. At certain periods of the year it is found in considerable numbers. The other is a South American insect, figured long since by Francillon, under the name of the Kanguroo Beetle, Scarabæus macropus, in which the size of the hind legs is still more extraordinary. This insect has recently been received from America, and proves to be the male of Mr. Kirby's genus Chrysina. The Chrysophora (or rather n. g.) Kirbii *Gray*, in Griffith *An. K.* from Brazil, and the Heterosternus buprestoides *Dupont*, figured in the *Mag. de Zoologie*, from Mexico, are also especially interesting. This family is very interesting as regards the natural distribution of the Linnæan Scarabæi. Whilst, on the one hand, it is so intimately allied to the Dynastidæ in the general structure of the mouth that Latreille has united it therewith, under the name of Xylophili; on the other hand it very nearly approximates to many of the Fabrician Melolonthæ, and especially to

the Anoplognathidæ and Cetoniidæ, the former of which families have the mandibles concealed beneath the clypeus, and the maxillæ obtuse; whilst the Cetoniidæ (to which, in general habit and appearance, the species bear a great resemblance) have the mandibles membranaceous. Hence it is evident, that the affinity of the Rutelidæ with the Anoplognathidæ is much stronger than with the Cetoniidæ. I have therefore adopted the classification of the following families given in the 2d edition of the *Règne Animal.*

The seventh family ANOPLOGNATHIDÆ is also entirely composed of exotic species, closely allied to some of the insects of the preceding family, but having the clypeus dilated in front, entirely concealing the mouth (*fig.* 21. 14. underside of the head of Anoplognathus), with a transverse suture before the eyes; its anterior margin is acutely incurved, having the labrum, which is small and triangular, on its lower surface, which meets the front margin of the mentum, and thus closes the mouth. The mentum is large but of variable shape; the labium is completely concealed; the mandibles are large, horny, and generally obtuse at the tips, the base being internally dilated into a large square molary plate; the maxillæ are terminated by an obtuse lobe (*fig.* 21. 15.), which is seldom acutely toothed, but which, in some of the species, has several deep transverse impressions; the antennæ are 9 or 10-jointed, the club 3-jointed. The body is subquadrate, or ovate and subconvex; the thorax transverse-subquadrate; the scutellum distinct; the mesosternum often produced in front into a spine extending between the fore legs; the legs robust, with the posterior pair sometimes greatly thickened (*fig.* 21. 13. Repsimus Dytiscoides from New Holland); the anterior tarsi are occasionally dilated in the males, and the tarsal ungues are sometimes irregular, one or both being often toothed.

This family, although allied to the Rutelidæ in the produced mesosternum, the 3-jointed club of the antennæ and large size of the legs, evidently much more closely approximates to the Melolonthidæ, with which Latreille unites it under the name of Phyllophagi, but from which it differs in the obtuse, but singularly channelled maxillæ, and in the identity of form in the antennæ in the opposite sexes; the males being here distinguished by the large and square clypeus, the

dilated hind legs, the dilatation of the anterior tarsi, or the bearded mentum in the various groups.

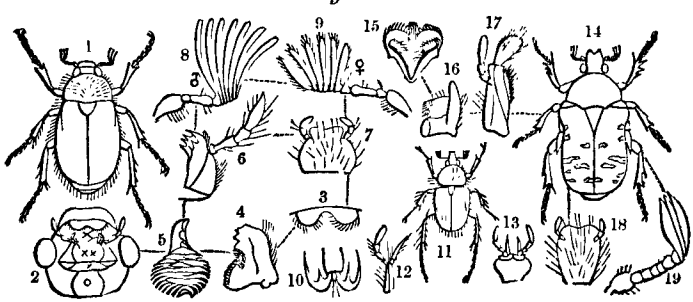
The habits of the New Holland species of these insects have not been recorded, but the molary structure of the internal base of the mandibles and the obtusely toothed maxillæ seem to prove them to be pre-eminently phyllophagous. The Brazilian species of Geniates fly round the trees in the evening, remaining amongst the leaves or in crevices in the bark during the day, and feeding upon the plants. The Leucothyrei, on the contrary, are not found amongst the leaves, but burrow into the soft trunks of trees, which they reduce to a soft paste (Perty.)

Mr. MacLeay considers that the larvæ of the typical genus are the New Holland grubs, said to be as useful to the natives as articles of food, as they are injurious to the agricultural hopes of the European settlers.

The species are numerous in New Holland and South America, where they appear to take the place occupied in the Old World by the Melolonthidæ; they do not appear to extend farther than 45° from the equator.

The eighth family MELOLONTHIDÆ is a very extensive and widely distributed group, distinguished by having the labrum transversely divided, generally into two lobes, the centre being more or less strongly

Fig. 22.



emarginate (*fig.* 22. 2. underside of head, and 22. 3. labrum of the common Cockchafer, Melol. vulgaris); the mandibles (*fig.* 22. 4.) are robust, horny, often obtuse at the point, but with the internal margin acute at the apex, thus serving to cut the leaves upon which the insects feed,

and which are subsequently gnawed in pieces by means of the broad square molary portion of the internal base of the mandibles (*fig.* 22. 5.); the maxillæ are terminated by a horny truncated piece, which also exhibits several (generally five or six) acute teeth (*fig.* 22. 6.); the clypeus is large and separated by a strong transverse suture, which extends between the front of the eyes. The antennæ are 9- or 10-jointed, with the club large and composed of a variable number of joints (three to seven) according to the genus and sex, the plates being also considerably elongated in the males (*fig.* 22. 8. antennæ of Mel. vulgaris ♂. 22. 9. ditto, ♀.). The mentum is subquadrate or subovate-truncate, narrowed at the tip, of which the anterior margin is emarginate (*fig.* 22. 7.). This organ arises at the base from a transverse, narrowed piece (*fig.* 22. 2. x), which is part of the skull, although apparently articulated, and is the front part of the jugulum (*fig.* 22. 2. o.), it is the piece prébasilaire of Strauss; the head is subquadrate, the body ovate and subconvex (*fig.* 22. 1. Rhisotrogus solstitialis, the common July Dor); the elytra do not conceal the extremity of the abdomen; the scutellum is distinct; the metasternum very rarely porrected and the legs slender, with the tarsal claws often of irregular size and variously toothed (*fig.* 22. 10. claws of Mel. Fullo.).

Mr. MacLeay considers the Serica brunnea as the type of this family, probably regarding the more developed structure of the antennæ of the common Melolontha as aberrant from the ordinary 3-jointed club of the majority of the family. From the importance of the genus Melolontha in the economy of nature, and their large size, I should be induced to consider them as the real types.

The Melolonthidæ are rarely adorned with those brilliant metallic tints which ornament the Rutelidæ and Cetoniidæ; their bodies, on the contrary, are generally clothed with a slight pubescence, or layer of minute scales.

The terms Μηλάνθη or Μηλολάνθη or Μηλολόνθη appear to have been applied by the ancients to Scarabæi which flew about apple-trees; and Eustathius describes them as larger than a wasp; hence, as the Melolonthæ of entomologists seldom frequent flowers, Mr. MacLeay conjectures that the name has been erroneously applied to these insects, and ought probably to have been given to the Trichius fasciatus, or some of the Amphicomæ, belonging to the family Glaphyridæ. As, however, the spinning of Cockchafers (a species of cruelty known to every schoolboy) is also mentioned by Aristophanes in his *Comedy of the Clouds*,

as having also been practised with the Melolonthæ (Act 2. scene the last); we may, perhaps, question the propriety of Mr. MacLeay's conjecture: the Grecian boys, however, only tied a string round the legs of the beetle instead of putting a pin through its tail. (*Strutt's Sports*, p. 390., Hone's edition.)

These insects are very intimately allied to the Anoplognathidæ (from which they differ in their labrum and toothed maxillæ), and Rutelidæ which have the mesosternum generally porrected. The structure of the mouth, however, as well as the variation in the tarsal claws are characters by which they are most closely associated with the last named family; indeed the genera Hexodon and Chalepus appear to form a perfect passage, the latter genus being associated with the Rutelidæ by Latreille, and with the Melolonthidæ by MacLeay. From the Glaphyridæ and Cetoniidæ they are at once distinguished by the corneous structure of their mandibles and maxillæ.

The common Cockchafer (Scarabæus Melolontha *Linn.* Melolontha vulgaris *Fabr.*), is, at the same time, the best known, most common, and destructive of the Coleopterous insects, flying about in swarms in the evenings of May and June, resting during the day in hedges and trees, upon the leaves of which they feed most voraciously, sometimes defoliating extensive districts; the females burrow into the earth and there depositing their eggs, the larvæ are hatched at the end of six weeks, and are generally known by the name of the white worm, and in Ireland, the Connaught worm*, devouring the roots of grass, in which state they continue for several years, and when numerous they are very injurious by completely stripping the ground of foliage, which dies off in consequence of the roots being eaten. In certain years these insects have appeared in such vast numbers that their ravages have been almost as extensive as those of the locusts. I cannot do more than refer to a paper by Baker in the *Philos. Trans.* vol. xliv., and another by Molyneux in the same Transactions for 1697, and to the statements recorded by Mouffet in his *Theatrum Insectorum;* to the Memoir in *Phil. Trans.* of the Dublin Society; also to Mr. Dillwyn's *Memoranda of Swansea Coleoptera*, p. 31.; and to Anderson, in *Recreations in Agriculture*, vol. iii. p. 420., who states that

* See Dryander, *Cat. Banks, Libr.* sub Connaught Worm. Bingley *Anim. Biogr.* vol. iii. p. 233.

14,000 Cockchafers were collected in a few days near Blois in France by children, at two liards per 100. In Hungary, according to M. Farkas (*Ann. Soc. Ent. France*, vol. ii. p. 339.) an oily matter is obtained by boiling numbers of the Cockchafers, and which is employed in greasing the wheels of carriages. (See also Kollar's *Obnoxious Insects.*)

Dr. Suckow has published a valuable little treatise upon the Natural History and Anatomy of the Melolonthæ, entitled, *Naturgeschichte des Maykafers*, Carlsr. 1824, 8vo. 3 pl.

M. De St. Leu. Taverny has recently communicated to the Academie des Sciences the result of experiments, proving that the most violent poisons (to man) have no effect upon the larvæ of the Cockchafer, whilst alkalies (Cyanuses) are the most speedy, certain, and economical mode of destroying them without injuring vegetation (*L'Hermes*, Feb. 1837.) See also *Observations sur les Mans*, (larvæ of M. vulgaris) et *les Hannetons* par M. Lefebvre *Act. Soc. Roy. d'Agriculture Mai*, 1791. *Kleeman's Preisschrift, von den Maykäfern, in Bermerkung der Churfu, Phys. Œkon. Gesellsch.* t. ii. 1770, likewise many articles in Loudon's *Gardener's Magazine, Encyclopædia of Agriculture*, and *Arboretum Britann.* p. 1822.

Both sexes of this insect are distinguished by having the extremity of the abdomen produced into a long and deflexed cone. Its internal anatomy has been investigated with very great labour by Strauss Dürckheim, ("*Considérations Générales sur l'Anatomie Comparée des Animaux Articulés.*" 4to. Paris, 1828, with an atlas of plates,) L. Dufour and Chabrier, ("*Sur le Vol des Insectes*" in the *Mém. du Mus.* vols. vi. and vii.). Germar has given an account of the injury done to wheat by the larvæ of Mel. ruficornis in company with those of Zabrus gibbus, in the proportion of about one-fourth (*Mag. der Ent.* vol. i p. 1—10.) Many of the other species fly together in swarms, some, as the male Hopliæ, preferring the morning, and others the twilight. They appear to be very generally distributed over the globe; several of the groups are, however, restricted in their localities; thus, whilst the thirty-eight species of Melolontha mentioned by Dejean, are almost exclusively European, his forty-seven Ancylonychæ (Mel. Quercina *Knoch*, &c.) are chiefly North American. Plectris, Philochlænia, and Ceraspis are chiefly Brazilian; Diphucephala, and several other small groups from New Holland, and Monochelus, Dichelus, &c. from the Cape of Good Hope.

The Phyllopertha horticola is sometimes exceedingly abundant during June and July, eating the leaves of various flowers, leaving only the fibres. In this manner they occasionally do great injury to apple and nectarine and other fruit blossoms (except pears), roses, &c. The larvæ, according to Stewart, feed upon the roots of Brassica lotris and capitata, leaving B. viridis and subarida untouched. See the Rev. W. T. Bree, in *Mag. Nat. Hist.*, No. xxix. for further interesting particulars respecting this insect. The Hopliæ, when alarmed, counterfeit death by extending their legs in a stiffened manner, and in different directions, the fore legs being advanced in front defending the head, the middle legs extended downwards, nearly at right angles with the body, and thus defending the under side, and the hind legs being direct upwards and backwards, defending the hinder part of the body.

Cist (*American Journ. of Science*, t. viii. p. 269.), has published a notice, with figures of a North American species of Melolontha in its different states which appears to resemble the common M. vulgaris of Europe. The figures are, however, very defective, and Dejean supposes (*Bull. Sc. Nat.* vol. ii. p. 174.) that the species is M. puncticollis.

Mr. Curtis has described and figured a very beautiful insect from Peru, belonging to this family, in the first volume of the *Trans. of the Zoological Society*, under the name of Ancistrosoma Klugii, in which the base of the abdomen in the male is armed with an acute deflexed spine. He has also figured a cocoon transmitted to him by Dr. F. Klug "from which, according to Pavon, this beetle was bred. The cocoon is ovate, hard, and somewhat like those of Trichiosoma Lucorum in texture; the operculum is semiorbicular, with a broad hinge, and narrow rim; the shell of the pupa is similar to that of other Melolonthidæ." Mr. MacLeay has, however, assured me that this cocoon is that of a Lepidopterous insect.

The GLAPHYRIDÆ *MacL.* or the Anthobii of Latreille is another exotic family, consisting of insects of a comparatively small size (*fig.* 22. 11. Anthipna abdominalis, from Italy), having the antennæ 10-jointed, with a 3-jointed club, the labrum exserted and coriaceous, the mandibles dilated and horny, with the inner margin coriaceous;

the maxillæ (*fig.* 22. 12. maxilla of Amphicoma Lasserii), are terminated by a membranaceous or coriaceous lobe, which is very pilose, forming a small brush, and occasionally furnished with minute teeth, the inner lobe is corneous and dentated, the lower lip is produced into two long membranous brushes (*fig.* 22. 13.); the body is ovate, depressed, squamose, or pilose; the elytra do not conceal the extremity of the abdomen, and in many species they do not meet in a straight suture along their whole length. The scutellum is distinct, the legs long, with the posterior femora sometimes incrassated. The tarsi are elongate and spinulose, the anterior ungues equal and simple, the posterior sometimes single, the hind legs are often remarkably dilated and toothed.

This interesting group of insects is well distinguished from the three preceding families by the more or less membranous structure of the maxillæ, the terminal lobe of which in some genera, as Lichnia and Cratoscelis *Erichson*, is very much elongated, being in the former of these nearly as long as the body. From the Cetoniidæ the Glaphyridæ are distinguished by their horny mandibles.

The species of this family are almost exclusively confined to the Old World, those of the typical genera Glaphyrus and Amphicoma appearing to be confined to the Northern Coast of Africa, and other countries bordering upon the Mediterranean and the south western parts of Asia, whilst Anisonyx and the allied genera abound at the Cape of Good Hope, the species being very rarely found within the tropics or in higher latitudes than 45°. They are said by Pallas to frequent flowers, of which they must be enabled to lap up the honey from the structure of the maxillæ, whilst the hairiness of their bodies must render them serviceable in effecting the impregnation of plants.

According to Pallas, as quoted by Mr. MacLeay, they are chiefly vernal insects, and are found in liliaceous flowers, adding, that it is probable that the larva of one of the species lives on the bulbs of the tulip, giving however no reason for this opinion.

The tenth, and last family of the Lamellicornes, or the CETONIIDÆ *MacL.* (Melitophili *Latr.*) is an extensive and brilliant group of insects, having the body oblong-ovate, and depressed (*fig.* 22. 14. the common Rose Chafer, Cetonia aurata); the antennæ 10-jointed (*fig.* 22. 19.), the labrum (*fig.* 22. 15. membanaceous and concealed beneath the

clypeus, with the anterior margin emarginate; the mandibles are compressed, slender, lanceolate, furnished internally with a somewhat square membrane (*fig.* 22. 16.); the maxillæ are horny subtrigonate, with the inner margin membranous and ciliated; the terminal process entire, membranous, compressed, and setose (*fig.* 22.17.). The mentum is large and pitcher-shaped, entirely concealing the labium (*fig.* 22.18.). The scutellum is distinct, although, in some species having the posterior margin of the thorax lobed (Gymnetis) this part of the body is concealed, the mesosternum is often produced into a point in front, extending between the anterior legs, which are slender, and the tarsal claws are entire and of an equal size. But a more important character, which is found in a great number of the species, is the greatly developed epimera of the mesothorax, which are so large that they here occupy the space between the posterior lateral angles of the prothorax and the humeral angles of the elytra, which are pushed considerably backwards to make room for the epimera. The elytra do not conceal the extremity of the abdomen.

In the perfect state these insects frequent flowers, upon the juices of which they subsist, the structure of the maxillary lobes enabling the insect to lap up the sweets. Other species are found upon the trunks of trees, particularly such as are wounded, and from which the sap flows. Rösel states that he kept a Rose Chafer alive for three years, feeding it with fruit and moistened white bread. Hence Latreille states, that in the perfect state they do no mischief to the essential parts of flowers; but in a communication by Mr. St. John, published in the *Mag. Nat. Hist.*, No. xxiii., a Maltese species (Cet. hirta), which is called Bouzuff by the natives, and Botany Bay by the English residents, does much mischief to the flowers of the apricot, of which it eats the nectary. This is not improbable, because, upon dissection, I find the maxillary lobes of this species are armed with horny teeth. There are many articles upon the Rose Chafer in the *Gardener's Magazine.* See also Blot. in *Mem. Soc. Linn. du Calvados*, vol. i. on Trichius nobilis and Cetonia aurata. M. Westermann has mentioned a curious circumstance respecting the Cetonia carnifex and pubescens (Cape G. H.), namely, that he never found them upon flowers but always under dried cowdung (Silberm, *Rev. Ent.*, No. 3.). The Brazilian Yncæ repose, during the morning, in the plantations of Zea Mays, sitting under the leaves. They fly during the day round the high trees, upon the leaves of which they feed: all the Brazilian

species of Cetoniæ are found upon leaves. The larvæ feed upon moist rotten wood, almost reduced to a state of decomposition. Those of Aleurostictus variabilis have been found by Messrs. Griesbach in rotten oak-trees; they have thus been enabled to rear many of these rare beetles. The most common British species is the beautiful Rose Chafer, Cetonia aurata, which abounds upon the roses, and especially upon the flowers of the privet in the south of England. Its larvæ are often found in ants' nests. This family is at once distinguished from all the preceding families of Thalerophagous Petalocera by the membranaceous structure of the mandibles and maxillæ.

These insects are very widely dispersed, but more especially frequent tropical climates. The genera Trichius and Cetonia, as now restricted, are found in all quarters of the world, whereas the Gymnetes are almost exclusively South American, and the Macronotæ are chiefly Javanese. Tropical Africa is inhabited by the gigantic and very rare Goliaths, in which the front of the head is produced into two anterior and two lateral horns, and which are distinguished from every other species in the family by their strongly toothed maxillæ, indicating a mode of life at variance with that of the ordinary Cetoniæ. (See Drury, *Exot. Entomol*, 2d edit. by Westwood; Klug, in *Erman's Reise am Erde;* Hope, *Coleopt. Manual.*) Messrs. Gory and Percheron have illustrated the species of this family in their splendid *Monographie des Cétoines*, now completed. Latreille divides this family into three sections — Trichides, Goliathides, and Cetonides, distinguished by the structure of the mentum and mesosternum.

The remaining subtribe of Pentamerous beetles, which I have named PRIOCERATA* (SERRICORNES *Latreille*), comprises several families of insects, having the antennæ short or but of moderate length, very rarely thickened at the tips, being generally of equal thickness throughout, or more slender at the extremities, and often toothed, serrated, or pectinated (*fig.* 23. 2.), especially in the male sex. The outer maxillary lobe is not palpiform (*fig.* 23. 3.), so that the insects have only two maxillary, and two labial, palpi, these organs being generally short and robust; the body is commonly elongate and narrow, and the elytra (with few exceptions) entirely cover the abdomen.

* Vide p. 178. antè.

The larvæ are, for the most part, elongate, and furnished with strong jaws and six thoracic legs, in which state, as well as when arrived at perfection, they are eminently vegetable feeders; a few, however, prey upon other insects, both in the larva and perfect states.

In the '*Genera Crustaceorum*,' &c. Latreille divided his great group of Saprophagous Coleoptera into eighteen families, including the Sternoxi, Malacodermi, Clerii, Ptiniores, and Palpatores; but in his *Familles Naturelles* he united the four latter families into a section termed *Malacodermi*, adding a third, Xylotrogi. In the second edition of the *Règne Animal*, more recently he has endeavoured to effect a natural transition between the Sternoxi and Malacodermi, by proposing another intermediate section for the reception of Rhipicera, &c., and by removing the Cebrionidæ from amongst the Malacodermi to the Sternoxi, as a distinct division, connecting the Sternoxi with Rhipicera, &c.; the genus Dascillus (Atopa) at the end of the latter leading to Scyrtes (Elodes), at the head of the Malacodermi. Although, however, Rhipicera and Cebrio evidently form portions of the passage between the Sternoxi and Malacodermi, they appear to agree rather with the general characters of the latter. It is true, indeed, that in the firm consistence of the body, which was Latreille's chief reason for removing them from the latter subsection, they agreed rather with the former; yet many other Malacodermi have the body quite as firm as it is in these genera. In like manner, the Cebrionidæ possess so few of the characters of the Sternoxi, whilst they so closely agree with Rhipicera, that I prefer leaving them in the same family.

Uniting also the Xylotrogi with the Malacodermi, as subsequently noticed, the Serricornes will form two divisions, to which it will be more correct, as well as convenient, by way of comparison to give the names of, 1. MACROSTERNI (in lieu of STERNOXI), having the prosternum large, produced into a point; and 2. APROSTERNI (in lieu of Malacodermi), with the prosternum simple.

The first of these divisions MACROSTERNI * (STERNOXI *Latreille*), comprises the Linnæan genera Buprestis and Elater, in which the body

* BIBLIOGR. REFER. TO THE MACROSTERNI (STERNOXI *Latr.*).

Latreille. Mem. in Annales Soc. Ent. de France, 1834.

Say, in Annals of Lyceum, Nat. Hist. of New York, vol. i. 1824.

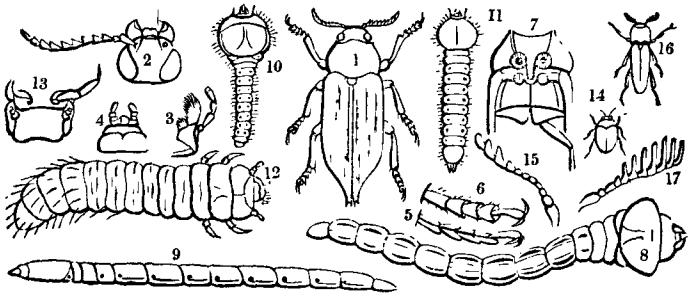
is of a firm consistence, the prosternum or pectus of the prothorax advanced in front beneath the mouth, and generally with an impression on each side beneath for the reception of the antennæ (which are always short), and likewise posteriorly produced into a point, which is received into an excavation in front of the mesosternum, or pectus of the mesosternum; the legs are partially or entirely retractile; the head inserted vertically, as far as the eyes in the frontal cavity of the prothorax; the body is generally of an elliptic elongate form, sometimes conic or trigonate, and narrowed behind; the legs are short, and the posterior angles of the thorax more or less acutely produced.

In their perfect state, these insects feed either upon wood, leaves, flowers, or sap; the larvæ are several years in arriving at their full growth.

The two Linnæan genera above-mentioned form the types of the two families Buprestidæ and Elateridæ, the transition between which is very gradual, so that the point of separation is obscure. M. Lacordaire, in his Memoir upon the habits of the Coleoptera of South America (*Ann. des Sc. Nat.* June, 1830), has observed that various genera, such as Pterotarsus, Galba, Eucnemis, Lissomus, and Cryptostoma, ranged by Latreille amongst the Elateridæ, have not the power of leaping, which so eminently distinguishes this family, the convexity of their bodies preventing them from obtaining a "*point d'appui*" upon the surfaces upon which they are laid upon their backs, and are consequently able only to roll over; and therefore suggesting that, from their habits, they should form a distinct family, nearly allied to the Ptinidæ and Lymexylonidæ. Without, however, denying this affinity, Latreille has endeavoured to remove the difficulty by the establishment of two new tribes or families, namely, the Eucnemides, more nearly allied to the Buprestidæ, and the Cerophytides to the Elateridæ. As these two groups are, however, of very small extent, and as they possess many characters in common, I shall provisionally consider them as forming one group (Eucnemidæ) of minor value, divisible into two sections, intermediate between the Buprestidæ and Elateridæ.

The first family BUPRESTIDÆ* *Leach* is composed of some of the most splendid of the beetle tribes, forming the Linnæan genus

Fig. 23.



Buprestis. The body is of a hard consistence, generally of an oblong-ovate, and depressed form, occasionally narrow and linear (*fig.* 23. 1.

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* BIBLIOGR. REFER. TO THE BUPRESTIDÆ.

Latreille. Genera Crust, &c. vol. i.
Dalmann, in Schonh. Syn. Ins., vol. i. part 3.
Eschscholtz. Zool. Atlas (in which 15 genera are introduced.)
Solier, in Annales Soc. Entomol. de France, 1833 (in which 34 genera are established.)
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Spinola, in Annal. Soc. Ent. France, for 1837.
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And the general works of Fabricius, Olivier, Herbst, &c.

Dicerea Berolinensis from Germany); the elytra are for the most part narrowed at the tips, which are often denticulated; the head is very short (*fig.* 23. 2. head of Ancyl. rustica), and immersed nearly to the eyes in the thorax; the legs and antennæ are short, the latter (*fig.* 23. 2.) being serrated; the scutellum is often obsolete; the thorax broadest behind, with the posterior angles but slightly produced. The posterior projection of the prosternum (*fig.* 23. 7.) is flat and obtuse, not compressed at the sides, as in the Elateridæ; this structure being consequent upon motions of the insects, which are unable to leap when laid upon the back, like the insects of that family; the prosternum is also occasionally produced in front; the tarsi (*fig.* 23. 6.) are short and generally dilated and cushioned beneath (*fig.* 23. 5.), the third and fourth joints being cordate and pulvillose; the mandibles (*fig.* 23. 2.) are short, triangular, and entire at the tips; and the palpi are filiform, or but very slightly thickened at the tips (*fig.* 23. 3. maxillæ, 23. 4. labium of Capnodis cariosa.)

Nothing can exceed the splendour of colour in many of the species of this family (of which very few, of small size, are found in this country), being decorated with the most brilliant metallic tints; some have a general coppery hue, whilst some present the beautiful contrast of fine yellow spots and marks upon a highly polished blue, or green ground, and others exhibit the appearance of burnished gold, or of rubies inlaid on emerald or ebony. Hence, their elytra are employed not only by the ladies in China, but also in our own country, for the purpose of embroidering their dresses.

The perfect insects creep but slowly; they are, however, very active on the wing in the hot sunshine; but on attempting to seize them, they fold up their legs and antennæ, and fall to the ground. The abdomen appears to be composed of only five segments; the remainder are, however, internal, and constitute, in the female, a retractile, corneous, conical plate, employed for depositing the eggs in the chinks of the bark of trees within which the larvæ feed.

These insects appear to be much attached to the various species of fir-trees; whence probably their rarity in this country; and Dr. Hoppe records the discovery of Bupr. 8-guttata, which had been long regarded as extremely rare in Germany, in great numbers in a pine forest near Nuremberg, flying, during the month of July, in the hottest sunshine, and settling upon the horizontal roots of the Pinus sylvestris. Some species are occasionally found amongst flowers and upon leaves;

but the majority reside in thick woods and forests. They are also occasionally found in timber yards, and in newly-built houses, having made their escape from the wood of which the floors have been made, and in which they have passed the larva state. A most remarkable instance of this is recorded by Mr. Marsham, in the tenth volume of the *Linnæan Transactions*, respecting the Bupr. splendens, which was found alive whilst endeavouring to extricate itself from the wood of a desk made of a plank imported from the Baltic, and which had stood in one of the offices in the Guildhall of London upwards of twenty years, and upon the surface being planed away, the track of the larva was exposed. It is a curious subject for inquiry, in what state this long period had been passed by the insect.

In the first volume of the same *Transactions*, Mr. Dryander published a notice of the ravages occasioned by an immature specimen of the Bupr. canaliculata? which had eaten its way through a bale of piece-goods received from Bengal, containing fifteen pieces of muslin, of eight or ten folds in each, forming a passage about its own size.

From information furnished by Latreille to Mr. Kirby it appears, that the ocelli-like spots upon the elytra of the beautiful Bupr. ocellata, a specimen of which was brought alive from China to the Isle of France in wood, were observed by a friend of the former to be luminous. Mr. Percheron has, however, recently published some observations against this statement (*Rev. Entomol.* v. 3.).

Amongst the ancients, the names of Buprestis, Vulpestris, Bulpestris, Bustrepis, Bubestes, &c. were applied to a poisonous insect, which was supposed to cause oxen to swell, inflame, and burst. ("*βούπρηστις, παρὰ τὸ πρῆσαι τὰς βοῦς*, quia boves rumpit);" and, indeed, so noxious was this insect considered that, by the Cornelian law those who, with *malice prepense*, applied it in order to cause death, were themselves condemned to die. Geoffroy, adopting an opinion of Mouffet, considered it to be a species of ground-beetle (Carabus), to which he accordingly applied the name of Buprestis; but Latreille, who published a memoir upon the subject in the nineteenth volume of the *Annales du Muséum*, regarded it as a species of Meloe, which genus possesses equally strong vesicatory powers; whilst Messrs. Kirby and Spence, upon the authority of Belon, consider it to have been a Mylabris; and Mr. Hope (in Mr. Pettigrew's recent work upon *Mummies*) has suggested that it was an Œstrus; but as we learn from Elian, Dioscorides, and Galen, that the Buprestis had all

the stimulating properties of the Cantharides, being also, as Pliny says, " Scarabæis simillimum," the suggestion can scarcely be well founded Moreover, the insect which Belon discovered on mount Athos, having similar properties, was in his time termed by the inhabitants Voupristi, a name almost identical with the ancient names given above of the Buprestis. Hence, as well as from the still more explicit observation of Belon, that the Voupristi was " Cantharidi similis sed major, colore flavo vel luteo," the opinion of Messrs. Kirby and Spence (first suggested in fact by Latreille) appears the most tenable. Linnæus, however, notwithstanding its evident impropriety, applied the name of Buprestis to the harmless insects composing the present family, which Geoffroy, with considerable tact, termed Cucujus, a name used by the Romans to designate an insect of a golden green colour; the Linnæan nomenclature has, however, prevailed; but Fabricius and Olivier completed the confusion, by giving the name of Cucujus to obscure insects belonging to a very different family described above under that name.

Until within the last year or two, owing to the majority of these splendid insects inhabiting tropical regions, but little information has been procured relative to their natural history and preparatory states. Madame Merian, in her work upon the insects of Surinam, plate 50., has represented the Buprestis gigantea accompanied by a large white fleshy larva, with a curved body, resembling the larvæ of the Stag-beetle, having six legs, no antennæ, and the extremity of the body rounded and entire. It was found under ground, feeding upon the root of Convolvulus batatas; and from it the Buprestis is asserted to have been reared. As it is, however, so different from the now known larvæ of the Buprestidæ, and as, in all probability, the transformations are undergone in wood, the trunks of trees, &c., I fear that the authoress must have fallen into some error, although it must be observed that the same plate contains figures of Passalus in the larva and perfect state, the correctness of which has been ascertained.

In the collection of the Rev. F. W. Hope are preserved several specimens of a larva (*fig.* 23. 12.), sent from Brazil, in company with B. attenuata (*Kirby, L. Trans.*), being about an inch and a half long, cylindric, somewhat fleshy, not incurved, with the antennæ and organs of the mouth short; the legs of moderate length, but only four in number, and attached in pairs to the second and third segments, the fourth segment being also furnished with what may be regarded as the rudiments of another pair of legs, of very small size, and appearing

to be composed of three divisions (*fig.* 23. 13.). I know no other instance in which the two posterior legs are rudimental, whilst the four others are of the ordinary size. The last segment of the body is rounded and unarmed.

M. Westermann (in Silbermann's *Rev. Ent.* No. 3.) has published a short notice of the B. ocellata (India), and B. cuprea (Cape G. H.), of which he had observed the larvæ (which he did not fully describe); the latter species, as well as its larva, inhabits a species of Mesembryanthemum; the larva being very long, in proportion to its thickness, and of a yellow colour, with a brown head. I regret that he has not been able to furnish me with further details.

M. Audouin has discovered a larva, considered by him to be that of D. berolinensis, which forms numerous narrow galleries in the solid wood of beech-trees. No description has, however, yet been published of it. (*Ann. Soc. Ent. France*, 1836, p. xvii.) I am indebted to this distinguished entomologist for the accompanying figures (23. 8. and 23. 9.) of this larva, from which it will be seen that it nearly resembles, in many respects, the larvæ of the Cerambycidæ. It is of a fleshy consistence, and the large semicircular anterior segment of the body appears to me to represent the prothorax, within which the head is retractile. The prothoracic spiracle may be seen in the short piece which succeeds this large segment, and which is, I presume, the membranous connection between the pro- and mesothorax. M. Audouin, I believe, on the other hand, considers it to be the prothorax itself. There do not appear to exist the slightest rudiments of feet, and the terminal segment of the body is entire.

M. Aubé has more recently published the description of the preparatory states of Agrilus viridis, the larva of which he had detected in the stems of young beech-trees, which are much injured by its attacks. This larva is apod, and nearly agrees with that described above; being broadest in front, and gradually diminishing towards the extremity of the body, which is armed with two horny points. The larvæ underwent their change to pupæ at the beginning of May, and the imago appear about the middle of June. The pupa is considerably elongated, but does not offer any peculiarity of form (*Ann. Soc. Ent. de France*, 1837, p. 190.). M. Audouin has also discovered the larva of another species of Agrilus burrowing in the wood of the pear.

Dr. Ratzeburg has also published figures of the larva (copied in my *fig.* 23. 11.) and pupa of Agril. nocivus, in his *Forst. Insecten*, pl. 2., and which nearly correspond with those given by M. Aubé. He has also figured the larva (copied in my *fig.* 23. 10.) of A. fagi, which differs from the former, not only in the large size of the prothorax? and narrowness of the body, but (which is more remarkable) in wanting the conical points at the extremity of the abdomen. The structure of its maxillæ and labium is also different from M. Aubé's figures.

The insects of this family offer some remarkable peculiarities in their geographical distribution. Thus, at the Cape of Good Hope, is found an extensive group having the elytra ornamented with tufts of white or yellow hairs (G. Iulodis *Esch.*). The conical species abound on the shores of the Mediterranean, Caspian, and Black Seas, and at the Cape. Madagascar produces an extraordinary group, having the body flattened, and of a nearly rounded form; whilst, in New Holland, the genus Polychroma *Dej.*, and several others, have been exclusively discovered. Moreover, as the hottest climates produce the most splendidly coloured animals, the greatest number of the species of Buprestidæ (of which there are, probably, not fewer than 1500 species contained in the various collections), and the largest and most richly coloured species are found in the tropical and subtropical regions of both hemispheres; whilst, in the northern states, but few species occur, and in England scarcely more than a dozen species, of small size, are strictly indigenous. The largest species in the family are the B. bicolor (G. Catoxantha *Dej.* Java) and B. gigantea* (G. Stigmodera *Esch.*, Euchroma *Sol.* Brazil), and these do not exceed two and a half inches in length.

Latreille has recently proposed to divide this family into two sections, from the proximity or remoteness of the antennæ at the base; whilst M. Solier, followed by Messrs. Gory and Laporte, has founded his divisions upon the absence or presence of a scutellum, the form of that organ, and the insertion of the legs, employing the parts of the mouth for his generic characters.

Hitherto four genera only have been introduced into the British catalogues; the number is, however, much increased by the addition

* Mr. Kirby regards Buprestis gigas as the "original type of the genus," and consequently as entitled to retain the generic name Buprestis, which is entirely omitted in the recent works of *Solier, Dejean, Gory, and Laporte.*

of the generic groups established by the more recent continental authors. The indigenous or reputed indigenous species may be accordingly generically arranged as in my Synopsis.

Of these indigenous insects, the species of *Anthaxiæ* are small but elegantly coloured insects, of a rather broad form; the *Agrili* and *Aphanistici*, on the contrary, are linear. All the British species of this family are very rare, except the Agrilus viridis, which is repeatedly taken in the neighbourhood of London, especially at Coombe Wood, on the oak. The species of Trachys are minute; but easily known by their short subtriangular form. The typical species (T. minuta, *fig.* 23. 14.) is of a bronzed black colour, ornamented with greyish waived lines. It is found upon the hazel, upon the leaves of which it is said to feed. I have always found the Aphanisticus pusillus in dry moss, at Coombe Wood, in the spring. This genus is distinguished from all the other Buprestidæ by its clavate antennæ (*fig.* 23. 15.).

Amongst the exotic genera, in addition to those already noticed, may be mentioned that of the Sternocera, composed of various large and splendid Indian species, in which, as the name implies, the mesosternum is produced into a spine, covering the base of the prosternum, in which respect it agrees with the Cetoniidæ.

The second family EUCNEMIDÆ* (which, as above stated, must be regarded as provisional only) comprises the two small groups termed by Latreille, in the Memoir above referred to, Eucnemides and Cerophytides. They are jointly characterised by their inability to leap, the large terminal joint of their palpi, their antennæ often pectinated or serrated, and sometimes lodged, when at rest, in grooves on the

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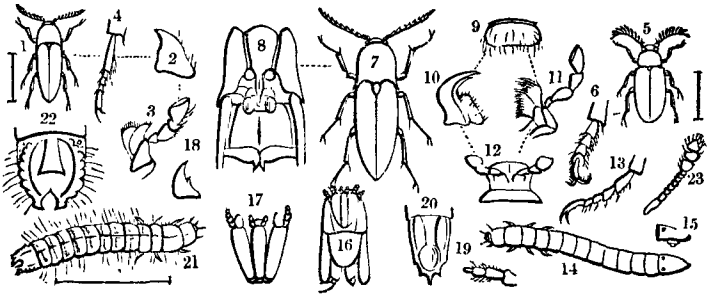
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under side of the thorax. I have already in (p. 225.) given an account of the habits of the chief genera as well as their names. They are for the most part exotic.

In the subfamily EUCNEMIDES the body is oblong and cylindric (*fig.* 24. 1. Microrhagus capucinus, *fig.* 2. mandible, *fig.* 3. maxilla,

Fig. 24.



(*fig.* 4. tarsus), the eyes circular and the basal joint of the antennæ large and subcylindric. There are only two British genera, Melasis and Microrhagus. Much confusion has occurred relative to the specific name of the type of the former genus, the same name having been applied to two apparently distinct species. More recently, however, Gyllenhal, Dejean, and Latreille have regarded them as specifically identical; so that it will be requisite to restore the Linnæan name instead of applying that of Elateroides or Flabellicornis. This insect (*fig.* 23. 16. the male, and 23. 17. the male antennæ) resides in decaying oak-trees, flying out of its cylindrical burrows in the hot sunshine with great agility, as I am informed by H. Griesbach, Esq., who discovered them in Windsor Park. The Rev. G. T. Rudd has likewise communicated to me some observations which he has made as to their mode of coupling, which takes place at the mouth of their burrows, the males remaining on the outside of the tree.

In the subfamily CEROPHYTIDES (*fig.* 24. 5. Cerophytum elateroides), the mandibles are terminated by a simple tooth, the body is ovoid, the antennæ are either lodged in the prosternal grooves, or are exposed; in the latter case they are ramose in the males; the tarsi are pulvillose and dilated, with the ungues denticulated (*fig.* 24. 6.). The only British genus strictly referrible to this subfamily is Cero-

phytum, to the typical species of which, in justice to Latreille, I have restored the name given by him. This insect has been once found in the neighbourhood of Bristol, and is in the collection at the British Museum. According to M. Chevrolat, from whom I have received the insect, it is enabled to make a slight leap, thus approaching the Elateridæ.

The curious little genus Throscus has much perplexed systematists, having been alternately placed in the Elateridæ, Byrrhidæ, or Dermestidæ: in its small size and perfoliate antennæ (*fig.* 24. 23.) it certainly disagrees with the Elateridæ, whilst its elliptic form and clavate palpi equally remove it from the Byrrhidæ, and the structure of its mouth and sternum from the Dermestidæ. Of these characters, the least important as *family characteristics*, are those which distinguish it from the Elateridæ, wherefore it seems more correct to place it in the situation here assigned to it; it appears, however, to me to form the connecting link between the Elateridæ and Byrrhidæ, in which latter family the prosternum is also prominent. Gyllenhal states that the typical species inhabits oaks, and Mr. Stephens says that he has found it plentifully on old oak wainscotting. I have, however, always found it (and somewhat abundantly) in sandpits, like the Byrrhidæ, although the second species, Thr. obtusus *mihi*, was beaten by me out of an oak-tree, in which, according to Hellwig (quoted by Gyllenhal) the larva of the former also resides. Gyllenhal adds "Tactus antennas pedesque arcte retrahit sed dorso impositus saltare potest uti Elateres." I have never, however, observed it to possess such a saltatorial power.

The exotic genus *Chelonarium*, whose situation has also equally perplexed systematists, is introduced into this subfamily by Latreille; the body is suborbicular, the second, third, and fourth joints of the antennæ long, and the remainder very short and slender; according to M. Lacordaire, they are found upon the leaves and flowers of various plants, from which they drop on the approach of danger. The species of this genus are chiefly found in South America, but Dr. Horsfield brought one from Java. In the genus *Cryptostoma* (Elater denticornis *Fab.* from Cayenne); the third joint of the antennæ is elongated into a linear branch.

The third family ELATERIDÆ* *Leach*, corresponding with the genus Elater of Linnæus, is very nearly allied to the Buprestidæ, having the body of a hard consistence (*fig.* 24. 7. Ludius ferrugineus); the antennæ short and more or less serrated; the legs and palpi are short, and the head immersed to the eyes in the thorax; the body is, however, more elongated and narrower than in that family; the posterior thoracic angles are produced into an acute spine, whereby all lateral movement is prevented, and the insects merely enabled to raise and depress the thorax; the tarsi are slender and simple (*fig.* 24. 13.); the labrum transverse (*fig.* 24. 9. labrum of Agriotes lineatus); the mandibles notched at the tip (*fig.* 24. 10.); the maxillæ bilobed (*fig.* 24. 11.); the mentum short, transverse (*fig.* 24. 12.), and the palpi terminated by a large triangular joint; the prosternum is produced behind into an acute compressed spine (*fig.* 24. 8.), which is received at the will of the animal into a groove in the front of the mesothorax, in front of the base of the middle legs, the latter peculiarity of structure resulting from the curious power which these insects possess, of springing when laid upon their backs. Being unable to recover their ordinary position in consequence of the shortness of the legs, Nature has amply supplied the apparent defect by providing them with an instrument which enables them to recover their position with facility. Folding their legs and antennæ close to the body (the latter being lodged in grooves on the underside of the prothorax), they lower the head and thorax until they come into contact with the surface upon which they are laid, by which means the prosternal spine is entirely drawn out of its oval groove in the mesosternum, when, by again suddenly throwing the head and thorax forwards, the

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* BIBLIOGR. REFER. TO THE ELATERIDÆ.

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Stevens. Mem. Soc. Imp. Mosc. t. 8.
And the general works of Fabricius, Drury, Herbst, Olivier, &c.

prosternal spine is driven with violence and a clicking noise into the mesosternal groove, whereby, and in consequence of the elasticity of the body, the extremity of the elytra being brought into contact with the ground, and the head and thorax as suddenly again forced backwards, the insect is raised to a considerable height in the air and falls generally upon its feet; hence, these insects have received the names of Skip-jacks, Spring-beetles, Clickers, and Blacksmiths, and, in Latin, Elater. Swammerdam calls them Grasshopper or Locust-beetles, and by old authors they were termed Notopoda. (See *Observations sur le Notopode*, by M. Weiss. *Act. Helv.* vol. ii.) They are found upon flowers, plants, the stumps of trees, in grass, &c., creeping slowly and falling to the ground on the least approach of danger. Mr. Rudd has published a short note relative to the "assembling" of the males of Elater cylindricus in search of the female (*Entomol. Mag.* vol. ii. p. 207.).

The number of species in this family is not so great as in the Buprestidæ, nor are these insects to be compared with the latter in the richness of their colours, being, for the most part, of obscure and dingy hues. Some few, however, offer exceptions to this observation, as the Selatosomus æneus, Elater sanguineus, &c. They appear to be more generally distributed than the Buprestidæ, about seventy species being inhabitants of this country; they are of a moderate size, but few species attaining the length of two inches, and few being under a quarter of an inch.

The larvæ of these insects are long and slender, and feed upon vegetable matters, under the bark of trees, &c., Messrs. Kirby and Spence consider them (or at least that of Agriotes segetis, or the wire-worm) as referrible to the chilognathiform type, and as to shape, best representing the full grown Iulus. De Geer has described and figured (vol. iv. pl. 5.) the larva of one of the species (El. undulatus *Pk.*, 3-fasciatus *Gyll.*, undatus *Gm.*), found under stones, in the ground, and in rotten wood. It is long, narrrow, and somewhat depressed, with very short antennæ, palpi, and six legs, and with twelve segments, exclusive of the head, covered with a hard and scaly skin, the last segment forming a nearly circular plate, with a recurved and 3-dentate margin, and terminated by two short pilose horns curved inwardly. On the underside, this segment is furnished with a large fleshy retractile tubercle, employed as a seventh leg. Messrs. Kirby and Spence mention this tubercle as being placed in a nearly semi-

circular space, shut in by the last dorsal segment, adding that this space is, in fact, the last ventral segment, and seems characteristic of the genus. As, however, the insect (including the head) has thirteen segments (which is the typical number in larvæ), exclusive of this tubercle, it is evident that it must be regarded only as a tubercle; the same structure prevails in many other genera. I have found this form of larvæ in very decayed rotten wood; but it is very difficult to rear them to the perfect state. Amongst my larvæ of this type of form, I observe seven or eight variations in the denticulation of the last segment of the body, there being as many as seven or eight teeth on each side, besides the bifurcate terminal horns in some individuals (*fig.* 24. 22.). Amongst them is also one (*fig.* 24. 21.) which I find not uncommonly at Coombe Wood creeping about the roots of moss; and as the Agrypnus murinus is found there in the same situation, as well as the exuviæ of pupæ, which appear to belong to this species, I have little hesitation in assigning it to that insect; indeed, I should imagine that this form of larva is peculiar to the genus Agrypnus, as restricted by the late authors.

The species of another group, to which Mr. Stephens, in allusion to their destructive powers, applied the name of Cataphagus (Agriotes), the type whereof is the Elater lineatus *Linn.*, or the El. segetis of Bjerkander, have differently formed larvæ. Those of the last-named species, and of El. obscurus of Marsham (*Linn.* ?), which, indeed, Messrs. Kirby and Spence regard as a variety of the former, are known by the name of the wire-worm (*fig.* 24. 14.), from their slender cylindric form and hard texture; they are of a fulvous colour; their legs are so short as to be scarcely visible beyond the sides of the body, the terminal segment of which is entire, longer than the preceding, and terminating in an acute mucro at the apex, with a deep circular impression on each side at its base above (*fig.* 24. 15. terminal segment seen laterally.) These impressions are doubtingly regarded by Messrs. Kirby and Spence as spiracles. As, however, their position is certainly not that of spiracles, and as the *other* larvæ of this family are destitute of them, and, moreover, as this larva possesses a series of spiracles on each side of the body (overlooked by Messrs. Kirby and Spence), they ought scarcely to be regarded as such. *Fig.* 24. 19. represents the antenna; *fig.* 16. the underside of the head and prothoracic segment, and *fig.* 17. the maxillæ and labium.

A figure of this larva was given by De Geer, vol. v. pl. 12. f. 4. 5., who, however, was unacquainted with its transformations. Another figure (of El. obscurus) was given by Mr. Marsham, *Linn. Trans.* ix. pl. 18. f. 4., copied in the *Introduction to Entomology*, vol. iii. pl. 18. f. 4.; but the first segment of the body is incorrectly represented without legs, and a pair is given to the fourth; the terminal segment is also misrepresented as furnished with two lateral apical lobes. The ravages of these larvæ, which feed upon the roots of wheat, rye, oats, barley, and grass are occasionally so extensive as to render it necessary to resow the ground; and, when it is added that (according to Bjerkander, who has published an account of this insect in the *Stockholm Transactions* for 1779 *) it is five years in arriving at the perfect state, the amount of damage which they commit may be easily believed. They will also attack the larger roots of turnips (eating to the centre of the root), potatoes, carrots and salads, likewise cabbages, (*Gard. Mag.* iii. 381.) Irideæ, pinks, lobelias, &c. (*Ibid.* p. 493.). I once found one of them in the stem of a lettuce plant, the interior of which it had completely devoured. This larva crept tolerably quickly, with a sliding kind of motion, the tail being bent on one side somewhat like the letter S. I never observed it, or indeed any of the larvæ in this family, roll themselves up like the Iuli. The wire-worm is evidently very fond of the lettuce, for Mr. Hogg (*Gard. Mag.* iv. 317.) mentions the great service, which he has found in laying slices of it as a bait for them, and Sir Joseph Banks recommended the same mode of capture, only substituting slices of potatoes for the lettuce. It is not generally known that the mole devours great quantities of these worms. Pheasants are also equally serviceable, since I have heard of instances where these birds, on being shot, have been found with their crops filled with wire-worms.

I possess several other larvæ perfectly agreeing with that of El. lineatus above described, but wanting the black spiraculiform marks upon the last segment, which is terminated by three points, the central one being the longest and most slender (*fig.* 24. 20.). Bouché in his *Naturgeschichte* has described and figured the larva of

* For further accounts of the ravages of the wire-worm, consult Marsham, in *Communications to the Board of Agriculture*, iv. 412. and in *Linn. Trans.* ix. 160. Passerini, Rapporta sopra l'opuscolo del Signor Negri, sopra il bruco che devasta i seminati di frumento. Kirby and Spence, vol. i. p. 181. Duncan, in *Quarterly Journ. of Agricult.* No. xxxvii. June, 1837. Westwood, in *Gardener's Mag.* Feb. 1838.

Elater fulvipennis *Hoffm.*, closely resembling that of El. obscurus *Marsh.*; the larva of El. sanguineus is also stated by him to resemble that of El. fulvipennis. The same author has also described the larvæ of El. fulvipes *Gyll.* (obscurus *Fab.*); niger *Linn.*, (aterrimus *Fab.*); and lineatus *Linn.*, (segetis *Gyll.*); the first differs from the larvæ of El. fulvipennis in having the terminal segment nearly square, with the posterior angles rounded, and the apical mucro larger; the second has the terminal segment rounded, the sides entire, with a terminal circular excision within the lateral margins; on each side is a series of four small tubercles. The description given of the third does not agree with Marsham's description of the larva of El. obscurus; the terminal segment being flattened, with the lateral margins uneven, and a small apical circular excision.

Gœdart has figured the larva and imago of an insect of this family in his table 108.

The larva of Elater noctilucus is very destructive in the West Indies to the sugar cane, feeding, according to Humboldt and Bonpland, upon the roots, and destroying the plants. Mr. Guilding (*Transactions Soc. Arts*), however, thinks that the damage done to these plants is, in a great measure, owing to other insects, as the Calandra saccharivora.

The large larva, hitherto regarded as that of Anthia 6-guttata, appears to be rather that of a large Indian species of this family (See *antè*, p. 68 note *.).

Mr. Dale (*Mag. Nat. Hist.* No. xix.) has recorded the capture of Elater sanguineus, and its larva and pupa on rotten oak stumps.

The distribution of this family into generic subdivisions has been but little, and only recently, investigated; a few of the more remarkable forms, it is true, had been established as genera; but until 1829, when the late Dr. Eschscholtz published a sketch of the family in Dr. Thon's *Entomologisches Archives*, vol. ii. (wherein many new groups are proposed, the total number being augmented to thirty-seven), the great majority of these insects were arranged under the generic name of Elater. At the end of 1830, Mr. Stephens, being unacquainted with Eschscholtz's Memoir, described the British species, amongst which he established several new genera, corresponding, in some respects, with those of Eschscholtz, who, previous to his decease, revised his former Memoir, and added twenty more genera in his manuscripts, which, subsequent to his death, were again revised by Latreille, and

the memoir of the latter (contained in the *Ann. de la Soc. Entomol. de France*, vol. ii., and in which the genera of Stephens are not noticed) was the last work which he lived to complete, thus rendering this memoir doubly painfully interesting, as combining the closing labours of these two distinguished men.

In my generic list, I have endeavoured to do justice to each of the three labourers above-mentioned, whose distributions are founded upon the laminiferous, or simple structure of the tarsi *; the serrated or simple form of the ungues; the form of the basal portion of the hind legs, and of the scutellum, &c.

Amongst the British genera of this family enumerated in the Synopsis, that of Ctenicerus is one of the most elegant, containing species of a metallic colour, with beautifully pectinated antennæ, whence Dr. Leach first gave them the name of Cleniocerus; Latreille, however, first characterised it under the name of Ctenicerus, which name I have retained in preference also to his more recent name of Corymbites, given to the same group.

The largest British species is the Ludius † ferrugineus. It is of a dirty red colour, with the scutellum and base of the thorax black, and is scarcely an inch in length. Most of the species to which the generic name of Elater has been restricted by Latreille and Stephens, are distinguished by the scarlet colour of their elytra. Dejean has, however, entirely dropped the generic name of Elater, employing for these insects the name of Ampedus of Megerle, whilst Mr. Kirby, on the other hand, regards the phosphorescent species as pre-eminently the types of the family (*Faun. Bor. Am.* 149.). The typical species of Campylis, distinguished by its large eyes, is extremely variable in its colours, the varieties having been considered as distinct species by various authors.

* There is very considerable variety in the nature and extent of the clothing of the underside of the tarsi. Many species have these parts simple, others have a single sucker on the fourth joint. In E. obscurus *L.*? the 2d and 3d joints have a cushion edged with hairs. A West Indian species, mentioned by Mr. Kirby, has three transverse reniform suckers on the 2d 3d and 4th joints. In E. niger the 1st 2d and 3d joints have a brush at the tips. In E. ligneus, &c. there are three large suckers on these joints; in E. flabellicornis there is a naked cushion on the four first joints, and in E. noctilucus the same joints are furnished with a brush (Kirby, *Faun. Amer. Bor.* p. 144.).

† Both in the *Règne Animal* and *Annales Soc. Ent. France*, Latreille gave the E. ferrugineus as the type of his genus Ludius. Mr. Curtis has, however, given it as the type of Eschscholtz's MS. genus Steatoderus, and misapplied the name Ludius for El. pectinicornis.

A remarkable monstrosity occurring ina specimen of Agrypnus murinus is described in the *Mag. Nat. Hist.* No. xxi. in which one of the antennæ consists of two 9-jointed divisions, arising from a 2-jointed base.

Amongst the exotic genera, Pachyderes *Guer.* is distinguished by the great size of the thorax, which is twice as broad as the elytra, with the posterior angles acute. Tetralobus and Hemirhipus are composed of species of a large size, with the antennæ short and strongly pectinated in the males. The Semioti *Esch.* (Eucamptus *Chevr.* Pericallus *Serv.* and *St. F.*) are handsome species, chiefly from Brazil, with the elytra spined at the tips; and the species composing the genus Alaus are distinguished by a pair of large black eyelike spots upon the thorax; but the most remarkable species in the family are some recently received from the Swan River by the Rev. F. W. Hope, who has published a description and figure of them in the *Trans. Entomol. Soc.* vol. i., under the generic name of Macromalocera, and in which the antennæ are as long as the entire body. He has more recently received the female of this genus, in which the antennæ are exceedingly short. In the second volume of the same *Transactions* he has figured two interesting species found in gum anime, which seem to be identical with two species figured by Dr. Klug, from Madagascar, and the same remark may also be made respecting a species of Tillus. The genus Pyrophorus *Illiger*, receives its name from the luminous powers of the insects of which it is composed, and of which this author has described sixteen (in the first volume of *Der Gesellschaft Naturf. Freunde Berlin Mag.* 1807); Dejean, however, enumerates twenty-eight, chiefly from South America, including the type El. noctilucus *Linn.* This species is upwards of an inch long, of an obscure brown colour, with an oval spot of a dull yellow colour near each posterior angle of the thorax. These spots emit so strong a light during the night (that being the period when they are in motion, reposing by day, when they are but seldom observed), that it is easy to read the smallest writing by placing several under a glass, or by moving a single insect along the lines. They are termed by the natives Cucuyos or Coyouyou, and by the Spaniards Cucujo, and, according to Bondaroy, Marechal. When the insect is on the wing two additional luminous patches are observed beneath the elytra; the light, indeed, shining out from beneath the abdominal segments when stretched out. It is said, that they are

attracted by the light of a flambeau, which they follow like moths, a circumstance which also occurs in the glowworms. According to D. Spix the light proceeds from a phosphorescent substance, contained in a small bag in the thorax, filled with unctuous matter like melted phosphorus, over which the tracheæ are spread. An interesting memoir by Dr. Bondaroy is contained in the *Mém. Acad. Scienc. de Paris*, 1766, upon one of these insects, probably brought to Paris in wood, which caused much alarm amongst the inhabitants of the Faubourg St. Antoine, where it had been seen flying about. Specimens have also been kept alive in the perfect state during the voyage from South America to England; and in the eleventh Number of the *Zoological Journal* is contained an account by Curtis of one which was brought alive to London. It fed upon wood during the passage, and it was requisite to moisten the woodwork of its cage daily to preserve it alive. Consult further upon these luminous species Spix and Martius, *Reise.* ii.; Perty in *Delect. Anim. Art. Bras. Præf.* p. 7.; Kirby and Spence, vol. ii. chap. xxv., *Entomol. Mag.* No. 11. and 12.; and Sells in *Trans. Ent. Soc.* vol. i. p. 46., in which the author opposes the statement of M. Laporte, that the splendidly luminous spectacle exhibited in tropical climates by fire-flies is caused by Lampyridæ, as well as the Pyrophori; and asserts that in Jamaica it is exclusively the latter which produce it.

The division APROSTERNI (MALACODERMI *Latr.*) is distinguished from the Macrosterni (Sternoxi *Latr.*) by having the prosternum neither produced in front over the mouth, nor forming a point behind, except in a few species (Cebrio) which evidently form the point of connection between the two divisions.

The body is generally of a soft or flexible consistence, with the head much deflexed; the antennæ of moderate length and filiform, serrated or pectinated, and the legs moderately long and slender.

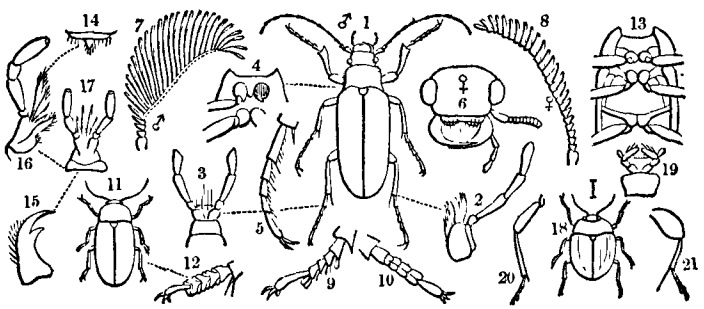
The insects are very active, flying with considerable rapidity over flowers, particularly those of the whitethorn and umbelliferæ. In their habits, the larvæ of the typical species are carnivorous, feeding upon other insects or worms, whilst others feed only upon wood. The structure of these insects is considerably different from that of the Macrosterni, but the affinities of such families, as the carnivorous-

feeding Telephoridæ, and Lampyridæ, with the Elateridæ, is satisfactorily established by means of Cebrio, Atopa, and Cyphon.

Adopting the arrangement of Latreille's earlier works, instead of uniting the Cebrionidæ with the Macrosterni, the Aprosterni may be divided into the following families:—Cebrionidæ (including the Rhipiceridæ), Cyphonidæ, Lampyridæ, Telephoridæ, Melyridæ, Cleridæ, and Ptinidæ. Latreille established a third division in the Serricornes, under the name of Xylotrogi, composed of the family Lymexylonidæ, which family Dejean united with the Ptinidæ under the name of Teredyles. I shall, however, provisionally regard the Lymexylonidæ as a family referable to the Aprosterni, to which division the families of Bostrichidæ and Scydmænidæ, from their apparent connection with the Ptinidæ, may also be provisionally assigned.

The first family, CEBRIONIDÆ *, is of small extent, but comprises several striking peculiarities of structure. The body is of an oblong

Fig. 25.



or oblong-oval form (*fig.* 25. 1. Cebrio gigas ♂, France), of a firm consistence like the Elateridæ, arched above and deflexed in front;

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* BIBLIOGR. REFER. TO THE CEBRIONIDÆ.

Latreille. Ann. Soc. Ent. France, 1834.
Leach. Zool. Journal, vol. i.
Laporte. Ann. Soc. Ent. France, 1834.
S. S. Saunders, in Trans. Ent. Soc. London, vol. i.
Kirby. Linn. Trans. vol. xii. (Rhipicera.)
Dalman. Anal. Ent. (ditto, Polytomus.)

the mandibles strong, curved, entire at the tip, and exposed beyond the upper lip, which is short, and the palpi are slender at the tips (*fig.* 25. 6. head of ♀ in front, 25. 2. maxilla, 25. 3. labium ♂); the thorax is broadest behind, with the posterior angles acute. The antennæ are generally longer than the head and thorax, and serrated or pectinated in the males; the legs are not contractile, nor formed for leaping (*fig.* 25. 5. posterior tarsus). These insects are of moderate size: they are for the most part inhabitants of the South of Europe, and the North of Africa; their colours are generally dull and obscure. But little is known of their habits, especially in their early stages. This family forms a very natural transition from such of the Elateridæ as Campylus, &c., to the soft-winged Telephori, &c.; some species being allied to the former in having the prosternum advanced behind into a point, but not produced under the head.

This family may be divided thus: 1. Those with the prosternum terminating in an acute point (*fig.* 25. 4.) (typical genus Cebrio); 2. Those without a prosternal mucro (Rhipicera, Callirhipis), having branched antennæ (*fig.* 25. 7. antenna ♂, *fig.* 8. antenna ♀ Rhipicera), and tarsal pulvilli (*fig.* 9. 10.), and Atopa, &c., having simple antennæ and wanting the pulvilli of the typical genus. Olivier observed that the Cebrio gigas (an inhabitant of the southern parts of Europe) is generally found during the evening, and especially after heavy falls of rain, and that its flight is very strong. M. Farines has, however, published a Memoir upon the C. xanthomerus *Hoff.* (*Trans. Linn. Soc. Bordeaux*, vol iv. and *Ferussac Bull*, 1830, p. 477.), from which it appears that this species appears only during the early autumnal showers; at which

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Guérin. Icon. R. An. and Mag. d'Ent.

Fischer. Lettre sur le Physodactyle, Nouv. Genre de Coléopt. Elateroid. Moscow, 1824. 8vo. (Drepanius *Perty*) and Annal. Sc. Nat. vol. iii.

Knoch. Neue Beytrage. Erste Theil, tab. 5. (Sandalus.)

Griffith. An. Kingdom, Insects.

Westwood. (New Edit. of Drury, vol. iii.) — Ditto in Jard. Mag. Zool. and Bot. vol. i. (G. Cladotoma.)

Palisot Beauvois, Ins. d'Afr., &c.

Germar. Sp. Nov. Insect.

Eschscholtz. Zool. Atlas, t. iv. (Epiphanis.)

Charpentier. Horæ Ent t. i. (Dima.)

Guérin and Perchéron. Genera des Insectes.

Nov. Act. Soc. Roy. Upsal, 1827. — Mem. Soc. Nat. Moscow, vol. vi.

period, if the weather be fine, few only are to be found; but if very wet, great numbers of males are observed creeping about the ground (from which they have recently emerged) and eagerly searching for the females. M. V. Audouin has also more recently described (*Ann. Soc. Ent. France*, vol. ii.) the coupling of C. gigas, the female of which had previously been very rare in collections, which arose from the peculiarity of the habits of this sex, which is seldom seen out of the ground, its ordinary situation being beneath the surface; above which, at the period of coupling, it protrudes a long horny tube, the extremity containing the organs of generation; this organ being also employed to introduce the eggs to a proper depth under ground. M. Graells of Barcelona has published a series of observations to the like effect in the same work, 1837, p. 93.

Dr. Leach published a Memoir upon Cebrio in the *Zoological Journal*, No. 1., in which several subgenera were separated from that genus, and in which the tarsi were erroneously stated to be heteromerous. Dejean, however (*Bull. Sc. Nat.*, Sept. 1824), considered that some of Leach's groups were formed upon the females of various species of Cebrio; and which, indeed, differ remarkably from the other sex, the female of C. gigas, for instance, being much more robust, with short rounded elytra and antennæ scarcely longer than the head, and clavate. (*fig.* 25. 6.)

The exotic genus Callirhipis is remarkable for having its long eleven-jointed antennæ very strongly pectinated in the males. Rhipicera *Latr.* is similarly characterised; but the antennæ have from twenty to forty joints. M. Laporte has recently published a valuable Monograph upon this and other allied genera.* (*Ann. Soc. Ent. Fr.*, vol. iii.) Latreille also, in the same volume, gave a sketch of the family, including descriptions of the genera; and M. Lacordaire has published some observations on the habits of Rh. marginata, stating that it appears during, and towards the conclusion of, the rainy season. It is found in the forests upon low plants, gnawing the leaves and

* M. Laporte has introduced the extraordinary genus Sandalus (having but slightly pectinated antennæ) amongst his Rhipicerites, notwithstanding its evident affinity with Atopa, as pointed out by Knoch, whilst he has placed Ptilodactyla, having very remote antennæ, amongst his Atopites. The genus Cladotoma *Westw.* (*Mag. Zool. and Bot.* vol. i.), although having beautifully flabellate antennæ, is most closely allied to Atopa. (*Fig.* 25. 14. labrum; 15. mandibles; 16. maxilla; and 17. labium of Cladotoma, the latter organs beautifully penicillated.)

under-stems, but is never observed upon flowers. This author considers that it undergoes its transformations in decaying trees, as he once observed a newly disclosed specimen sitting near the entrance of a burrow. They fly and walk but slowly, appearing very inactive in the perfect state.

The only British genus (but which is placed by Curtis in the family Telephoridæ) is Atopa, comprising but a single species, A. cervina (*fig.* 25. 11., *fig.* 12. tarsus, *fig.* 13. underside of the thorax of the same), which is not uncommon in hedges, appearing to be attached to chalky districts. The maxillæ and labium are terminated by long and slender hirsute lobes. Mr. Curtis has made some interesting observations upon the economy of this insect in his *British Entomology*.

The second family, CYPHONIDÆ, is a group of beetles detached from the foregoing, on account of their small size, hemispheric, depressed, or ovate, and rather soft bodies (*fig.* 25. 18. Eubria palustris, lately captured in Scotland by the Rev. Mr. Little), and furcate labial palpi (*fig.* 25. 19. labium of Cyphon melanurus): the mandibles are but slightly exposed: they are of dull colours, and are attached to plants in damp situations, and they fly and run with considerable agility. I have met with many individuals of Cyphon pallidus in the middle of winter, secreted in the stems of reeds, growing at Hammersmith. In some species, the hind legs are saltatorial, with the thighs dilated (*fig.* 25. 21. hind leg of Scyrtes); in the others they are simple (*fig.* 25. 20. hind leg of Cyphon).

The third family LAMPYRIDÆ†, or the glowworms, having for its type the genus Lampyris *Linn.*, is distinguished by having the body

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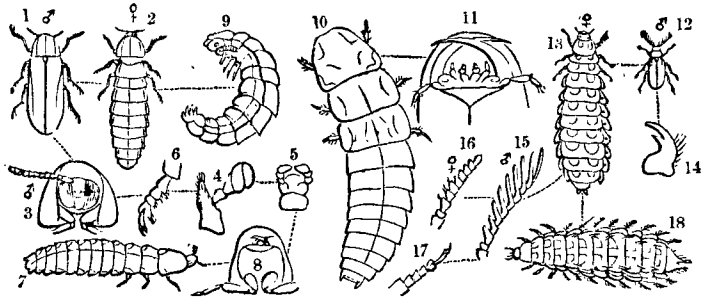
* BIBLIOGR. REFER. TO THE CYPHONIDÆ.

Germar. Mag. der Entomol. vols. iii. and iv.
Ahrens. Fauna Ins. Eur. Fasc, 5.
Guérin. Icon. R. An.
Stephens, Gyllenhall, &c.

† BIBLIOGR. REFER. TO THE LAMPYRIDÆ.

Laporte, in Ann. Soc. Ent. de France, 1833. (Revision of Lampyris.)
Bassi, in Guérin, Mag. Zool. vol. iii. pl. 99. (G. Malacogaster.)

Fig. 26.



elongate and depressed, of a soft consistence (*fig.* 26. 1. Lampyris noctiluca, the glowworm ♂; *fig.* 26. 2. ditto female); the head small, and concealed by the front of the thorax, with the eyes of the males very large (*fig.* 26. 3.). In some species the head is produced into a rostrum (*fig.* 27. 7.); the thorax is semicircular, or quadrate, forming a flattened hood over the head; the antennæ are filiform, and closely approximated at the base, and often pectinated or serrated, with compressed joints; the penultimate joint of the tarsi is bilobed (*fig.* 26. 6. ♂); the parts of the mouth are small; the palpi thickened at the tips (*fig.* 26. 4. maxilla, 5. labium ♂); the mandibles small, acute, and curved. In some species the females are apterous (*fig.* 26. 2.), and in others furnished only with short elytra. They are voracious in their habits; preying, in the larva state, upon the bodies of snails, and not, as asserted by some authors, upon plants. The species are, for the most part, ex-

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Griffith. Anim. Kingdom, Insects.
Thunberg. Dissert. Entomol. Upsal, 1784.—Ditto, in Act. Soc. Roy. Upsal, vol. ix.
Kirby. Century. Linn. Trans. vol. xii.
Guérin. Icon. R. An. Insects. —Ditto, Magasin de Zool. — And ditto, Voyage de la Coquille.
Schonherr. Syn. Ins. vol. iii. App.
Germar. Mag. der Entomol. and Insect. Spec. Nov.
Perty. Delect. An. Art. Brasiliæ.
Lamarck, Journ. d'Hist. Nat. vol. i.
Wulfen. Description of Insects, Cape of Good Hope, 4to.
Say. American Entomology, vol. iii. 8vo.
Newman, in Entom. Mag. No. 24.
Westwood, in Zool. Journ. No. 17. (on Amydetes.)
Hope, in Gray's Zool. Misc. No. i. — Ditto in Royle's Himalaya (G. Anisotelus).
Müller, in Illiger, Mag. vol. iv. (Nat. Hist. L. hemiptera.)

otic, and are often ornamented with red or yellow and black colours. None, or but very few, of the species exceed an inch in length. When alarmed they fold their antennæ and legs against the body, and remain motionless, as though dead; many, also, at such times, bend their abdomen downwards.

This family comprises three types of form, of each of which we possess a single English example; thus forming the types of as many genera. Several other species have been introduced into the British lists, but incorrectly.

The female of the English Lampyris is known by the ordinary name of the glowworm (*fig.* 26. 2.); its body is long, flat, and soft; the head small, and concealed by the thorax; and the antennæ and legs short (having much the appearance of its larva (*fig.* 26. 7.); from which, however, it is easily distinguished by the greater number of antennal and tarsal joints). The males (*fig.* 26. 1.), on the contrary, are furnished with perfect wings and wing-covers, and very large eyes (*fig.* 26. 3.). The light emitted by this insect from the extremity of the underside of the abdomen (several of the terminal segments of which are of a pale colour, indicating the extent of the luminous property) is too well known to require description. It is a sluggish nocturnal creature, often observed during the summer months*, in meadows, at the sides of roads, under hedges, &c. The males, which may occasionally be observed hovering over the females in the twilight, are also attracted by the light of candles or lamps; whence it has been supposed by most naturalists that this luminosity is given to the female,

> "To captivate her favourite fly,
> And tempt the rover through the dark."
>
> MONTGOMERY.

As however, the males, as well as the pupæ, larvæ, and even the eggs, are slightly luminous, some authors have rejected this supposition; but, as Latreille well observes, "on doit conclure que la substance phosphorique se développe dès le prémier âge." The glowworm possesses the curious property of causing its light to cease at will. On this subject there are some interesting observations in the chapter on luminous insects, in the second volume of the *Introduction*

* Mr. Bree (*Mag. Nat. Hist.* No. 25.) also states, in October and November; but the light observed by him at such times most probably proceeded from larvæ produced from eggs deposited during the preceding summer.

to Entomology; and Dr. Burmeister mentions the curious fact, that while catching some of the flying species in his hat, they have so suddenly and entirely ceased to shine, that he has fancied thatthey must have escaped. In the L. noctiluca, the males are but very slightly luminous; but in most of the large exotic species, the females of which are winged, both sexes emit a very strong light. When disturbed, these insects emit a bright but frequently interrupted light; and when laid upon their backs, they shine without intermission, in consequence of the continual motion of the abdomen, in the endeavours of the insect to regain its position. These glowworms have attracted the notice of the observers of nature from the earliest periods; they were termed by the old authors Lampyris, Cicindela, Lucio, Noctiluca, Incendula, Lucernuta, Lucciola, &c. And as they (as well as the luminous Elateridæ, with which they are generally confounded) abound in foreign climes, there is scarcely a book of travels published in which their splendid appearance in equatorial regions* is not dwelt upon; whilst their internal anatomy, and the phosphorescent nature of the luminous matter, has occupied the attention of Treviranus, Carradori, Forster, Beckerheim, Carus, Müller, &c. Mr. Murray, also, in his *Experimental Researches in Natural History*, has made the luminosity of the glowworm one of his subjects; and Mr. Todd, in the forty-second number of the *Journal of Science and Art*, and Messrs. Macaire and Macartney, in Gilbert's *Ann.*, vols. 61. and 70., have published some observations upon the same subject. From these researches the luminous matter is found to be of a phosphorescent nature; although the light is not augmented when placed either

* In some countries fire-flies in general appear to be named Cucuis by the natives, a name which we have seen is given to the luminous Elateridæ, although in some accounts it is evident that the insects thus designated, must be Lampyridæ, the light being only visible when the insects are on the wing, the situation of the luminous spots being on the back of the thorax in the former. This general employment of the term seems to be proved by the statement of P. Martire, quoted by Mouffet, that the Cucuji are caught for the purpose of feeding upon the gnats, where these abound, a circumstance so different from the habits of the Elateridæ, that it should evidently be applied to the Lampyridæ, which probably, like their allies the Telephoridæ, feed upon other insects. Dr. Burmeister, indeed, conjectures that the light emitted by the Cucuji (which he considers to be Elateridæ) may have the effect of keeping the gnats away; but which is totally at variance with the habits of the gnat in flying to lights. Mouffet, by whom the account of the Cucujos was quoted, described both the Elateridæ and Lampyridæ under the name of Cicindela.

in oxygen or hydrogen gas. It has also been ascertained that the animal is able to live a long time in vacuo.

The female glowworm deposits her eggs shortly after coupling, being thus occupied a day or two; these eggs are of a large size, and of a yellowish colour, and are placed in the earth, or upon moss and plants, to which they are affixed by means of a viscid fluid. The larva (*fig.* 26. 7.) is long, narrow, flattened, and composed of twelve broad transverse segments (exclusive of the head), to each of the first three of which a pair of short legs are attached; the anterior, (not the centre thoracic segment, as stated by Stephens,) is semicircular, and gradually narrowed in front. This segment, which represents the hood-like prothorax of the perfect insect, is similarly employed as a shield to the head, which is entirely retractile within the thoracic cavity, at the will of the animal (*fig.* 26. 8. the tips only of the mandibles being exposed.) The last abdominal segment is the narrowest, and its posterior angles are slightly produced. This larva is of an obscure black colour, with a pale spot at the hinder angles of each segment. The antennæ, palpi, and legs are short; the latter being strong, and terminated by a small claw. The mandibles are strong, acute, and curved. It may often be observed crawling slowly about footpaths, near hedges, and when disturbed it withdraws its head, and becomes immovable. It feeds (as does also the perfect insect) upon small molluscous animals, especially those of the genus Zonites, and not upon leaves or grass, as Latreille and others have generally supposed. De Geer, indeed, was led to believe, from the structure of its mandibles, that it was carnivorous; but it is only recently that his supposition has been proved to be correct. It is not difficult to rear this larva; but it is necessary to provide it, from time to time, with moistened earth and fresh food. An anonymous author* (*Bulletin Soc. Phil.* Feb. 1826) has published an account of the habits of this larva; in which it is stated that they will devour snails even in a putrefying state; and a peculiar apparatus is described, for the first time, consisting of a kind of "houppe nerveuse," composed of seven or eight white radii, capable of being protruded from the anal aperture, beneath the last abdominal segment, and which is employed, not only as a point of support, assisting in lo-

* This memoir is also given in the *Annales des Sciences Naturelles*, vol. vii. p. 353.; and is attributed to M. Maille. (Perchéron, Bibl. Ent. i. 267.)

comotion (as, indeed, De Geer had long previously observed), but also as an instrument to cleanse the head and fore parts of the body from the slime left upon them by the snails, whilst engaged in their repast.* The larva is stated by this author to attain its full size in April, when it prepares to assume the pupa state; from the commencement of which period, until it assumes the perfect state, fifteen days only are consumed, eight of which are passed in the pupa state. The shortness of the duration of this state may, perhaps, be accounted for, from the great similarity existing between the larva and female insect; whence there is but little change required to be effected in the constitution of the insect in these states. When the larva is ready to assume the pupa state, instead of slitting the skin in a line down the back, a slit on each side of the three thoracic segments is made, separating the upper from the lower surfaces; the insect then draws its head from out of the skin which had covered it, and the whole body is extricated through the aperture thus made; the insect immediately assumes a bent position, and becomes a pupa; but it has the power of moving its antennæ, legs, and head, as well as of twisting its body about, and pushing itself along by the alternate extension and contraction of the terminal segments of the body. The female pupa (*fig.* 26. 9.) is especially interesting; being, in fact, a perfectly apterous coleopterous pupa. In this state it has been figured by De Geer. The pupa of the male exhibits the ordinary rudiments of the elytra and wings.

I have represented at *fig.* 26. 10. a large flattened larva of this family, nearly allied to that of the glowworm, from the collection of the Rev. F. W. Hope, having long and very acute curved mandibles (*fig.* 26. 11.; head partly immersed in the prothoracic cavity). It is from Valparaiso, and is of a black colour, with two yellow spots in the front of the pronotum.

In addition to the various memoirs above referred to, De Geer's *Mémoire sur le Ver Luisant*, in the *Mémoires de l'Académie des Sciences de Paris*, vol. 2.; Mr. Wilson's *Entomologia Edinensis*, and the *Magazine of Natural History* for November, 1835, may be re-

* (See also *Bulletin des Sciences Naturelles*, June 1826, vol. viii. p. 296.) In the first number of Brande's *Journal of Science* is contained a paper by Mr. Rennie upon the cleanliness of animals, in which this anal apparatus (without acknowledgment) is magnified into a thick pencil of hairs, not unlike a shaving brush, employed by the insect in the manner above mentioned.

ferred to, containing excellent memoirs upon this insect; as well as a memoir by Müller, upon L. hemiptera, in the fourth volume of *Illiger's Magazine*, and another memoir by M. De Loche, upon L. italica (*Transact. Acad. Roy. Turin*, vol. 6.). In the elytra of this insect, as well as in L. noctiluca, Dr. Carus has observed the circulation of the blood. The figure given by Panzer (*Faun. Ins. Germ.* 41. t. 7. *c*, *d*) as the female glowworm is that of the larva of one of the Silphidæ.

The great number of exotic species, amounting to between two and three hundred, has rendered it necessary to separate them into various groups, of which the majority have perfect elytra and wings in both sexes. Hoffmansegg accordingly detached those South American species which have the male antennæ composed of nearly forty joints, and strongly feathered on one side (*fig.* 27. 9.), under the name of Amydetes. In the fifth volume of the *Zoological Journal*, I have published a memoir upon this curious genus, accompanied by descriptions and figures of two species. In the G. Phengodes *Hoffm.*, the antennæ are biplumose, and the elytra very short and narrowed to the tip, covering only a small portion of the wings. The type, P. plumosa *F.* inhabits North America, and is stated by Mr. Say to be not uncommon for a short period in the autumn. Attracted by the candle, it enters the house in the evening, and flies repeatedly against the ceiling in its endeavours to escape (*Boston Journ. Nat. Hist.* 1835, p. 157.). Other striking variations exist in the structure of the antennæ in the exotic subgenus Calyptocephalus *G. R. Gray*, and in that to which I would apply the name of Eucladisus (*fig.* 27. 10.), being the Cladophorus of Gray, but not of Guérin, which latter belongs to the genus Lycus, or the Ethra of Laporte, which latter name must also be rejected, being long previously employed in the Crustacea.

More recently M. Laporte has published a revision of the genus Lampyris, in which fifteen subgenera are proposed. (*Ann. Soc. Entomol.* France, 1833.)

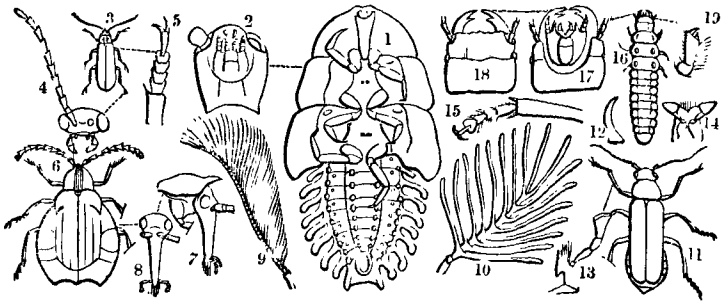
The genus Drilus is not luminous; but the disparity of the sexes is even greater than in the preceding genus (*fig.* 26, 12. Drilus flavescens ♂ —*fig.* 13. ♀) The females were not described* until

* It is evident, however, that the short notice given by Reaumur, vol. iv. p. 30., referred to this insect, the sexes of which were compared by him to a hare or a sheep by the side of a cow; the male having wings and elytra, but the female having no vestige of either.

Meilzinsky published (*Ann. Sc. Nat.* vol. i.) a memoir upon an insect, the larva of which he found feeding voraciously upon snails (Helix nemoralis). This larva (*fig.* 26. 18. larva of the ♀) is of a yellowish colour, eight or nine lines long, and four or five broad; its head is armed with a pair of strong bifid jaws, and two short 2-jointed antennæ; the body is 12-jointed, each of the three first segments bearing a strong pair of articulated legs, and each of the eight following segments furnished at the sides on the lower surface with two conical fleshy tubercles, or false legs, and on the upper with two raised bundles of hairs, forming a double series; the last segment is furcate, and bears the anus and two larger bundles of hairs; the former organ is deflexed, and employed as an extra leg, and is of much service to the insect when it endeavours to effect an entrance into the shell of the snail. After attaining the full size, and remaining all the winter in that state, the insect subsequently passes about twenty days in the pupa state (as ascertained by Desmarest, *Bull. Soc. Phil.* 1824.), from which issues forth a fulvous-coloured fleshy and apterous imago, three quarters of an inch long, to which Meilzinsky gave the name of Cochleoctonus vorax. Desmarest, however, succeeded in rearing the males of Drilus flavescens (about a quarter of an inch long) from the same kind of larvæ, thereby proving that the Cochleoctonus was the female of this genus; which fact was further confirmed by the discovery of the sexes united together, as well as by an admirable memoir upon their internal anatomy, by M. Audouin (*Ann. Sc. Nat.* vol. ii.), by whom it was also noticed that the exuviæ of the larvæ exactly close the aperture of the snail shell. The female exhibits the remarkable circumstance of having the thorax composed of three segments, similar to those of the rest of the body, thus resembling the structure of the larvæ. There is also a note, by Latreille, upon Meilzinsky's *Memoir* in the *Annales des Sciences Naturelles*, vol. i. (My *fig.* 26. 14. represents the mandibles; *fig.* 15. the male antennæ; *fig.* 16. the female antennæ; and *fig.* 17. the tarsus of the male.)

The genus Lycus comprises numerous singularly formed, and chiefly exotic, species, not materially differing in the sexes, both of which are winged; and none of the species have been ascertained to be luminous. The head is produced into a deflexed rostrum (*fig.* 27. 7. and 8.), a structure serviceable, on account of the insects being generally found upon flowers, particularly those of the Umbelliferæ: they also inhabit the decaying trunks of trees. In some of the exotic species (Lyc. latissimus, &c.), the elytra are

Fig. 27.



dilated at the sides, so as nearly to form a circle (*fig.* 27. 6. Lycus præmorsus, Africa). Their colours are gay, being generally fulvous or scarlet, variegated with black; the only British species is the Lycus minutus *F.*, belonging to the subgenus Dictyopterus, (*fig.* 27. 3.; *fig.* 4. the head; and *fig.* 5. one of the tarsi of the same): it is very rare, but has been found upon the oak, in the neighbourhood of London; it is black, with scarlet elytra, and is a quarter of an inch long. The larva of D. sanguineus *L.*, a reputed British species, resides, according to Latreille, under the bark of the oak; it is linear, flat, and of a black colour, except the last segment, which is red, forming a flat plate, having its extremity furnished with two kinds of cylindrical horns, apparently annulated and bent inwardly. Schonherr (*Synonymia Ins.* vol. iii. App.) has described and figured numerous species of Lycus.

I possess a very remarkable larva from Java (*fig.* 27. 1. under side), which I have no hesitation in referring to this family, from the manner in which the head is entirely immersed in the cavity of the first thoracic segment, the form of the legs, and terminal segment; when alive, it would be at least two inches long; I know not what insect it would produce, but it must evidently be a gigantic species in the group. As it exhibits no traces of luminous patches on the under side of the body, I should think it would probably belong to some species of Lycus; it is scarcely thicker than a doubled card. Dr. Perty has published a figure of this larva in his observations upon the Coleoptera of India, in which he doubtingly considers that it ought rather to be ascribed to a Necrophagous than a Malacodermatous insect. The body is nearly flat, and the first three segments very much larger and broader than the rest, which are armed at the sides with curved obtuse tubercles; the anterior segment is notched in

front, and its centre is formed beneath into a longitudinal tube, within which the head is capable of being entirely withdrawn; the anterior angles of the latter (*fig.* 27. 2., the head extracted from its tube) are formed into two rounded pilose lobes, which Dr. Perty has supposed serve as organs of taste; but as they are in no wise connected with the mouth, this opinion cannot be maintained. The same author has represented the head extracted from its prothoracic sheath, having a pair of large lateral ocelli, and a pair of thick jointless organs, which, in two specimens which I have dissected, were entirely immersed in a cavity at the anterior angles of the head. These organs, which Perty calls tentacula, are rudimental antennæ, and call to mind the sunk antennæ of the Hippoboscæ. The mouth, which Perty has entirely overlooked, is, indeed, very minute, but consists, as usual, of a pair of mandibles, very acute and small; a pair of maxillæ, of which the terminal lobe and 4-jointed palpi are capable of being withdrawn into the extremity; a broad mentum and lip; and a pair of minute 3-jointed labial palpi; the mentum and maxillæ are soldered together, forming a large flat membranous plate, covering the under side of the head in the centre. The mesothoracic, metathoracic, and eight following segments, have each a pair of spiracles.

I have also figured, from the collection of the Rev. F. W. Hope, another remarkable larva (*fig.* 28. 1.), nearly allied to the preceding, but of a narrow form, and of a black colour, with four longitudinal series of bright orange-coloured tubercles. The under side of the prothorax is formed as in the preceding, and the parts of the mouth are very weak. As the latter, and especially the mandibles, are very long and acute in the larvæ of the Lampyres, the supposition that these larvæ belong rather to some species of Lycus is strengthened.

The fourth family, TELEPHORIDÆ *, is so named from the typical genus Telephorus of *De Geer* and *Schaeffer*, corresponding with the

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* BIBLIOGR. REFER. TO THE TELEPHORIDÆ.

Fallen. Dissert. Monographia Cantharidum et Malachiorum Succiæ. Lundæ, 1807.

Charpentier. Horæ Entomologicæ, p. 194.

Nov. Act. Soc. Roy. Upsal, vol. iv. v. and ix. — Nov. Act. Soc. Roy. Denmark, vol. ii.

Bull. Soc. Nat. Mosc. vol. vi.

major part of the Linnæan genus Cantharis, which name is still employed for these insects by some foreign naturalists, who give to the medicinal Cantharides the generic name of Lytta.

These insects are of a soft consistence, and of a long and narrow form (*fig.* 27. 11. Telephorus rusticus ♀); they have perfect wings and elytra, and the eyes are of moderate size in both sexes. The head is broad and not concealed under the thorax; the mandibles are acute and curved (*fig.* 27. 12.); and the antennæ are simple, moderately long, and inserted close together; occasionally they are only 10-jointed; the labial palpi (*fig.* 27. 14.) are nearly as long as the maxillary (*fig.* 27. 13.), and they are all terminated by a securiform joint; the penultimate joint of the tarsi is bilobed (*fig.* 27. 15.). These insects, which are known by the common name of Soldiers and Sailors, are found in the spring in considerable numbers upon flowers, especially those of the umbelliferæ and whitethorns. They are very voracious, feeding upon other insects, and devouring such of their own species as they can subdue, the females not even sparing their mates. These circumstances were, indeed, doubted by Olivier, but they have been well authenticated, and I have, myself, been often a witness of their voracious dispositions; their flight is heavy, and they walk awkwardly.

De Geer has traced the history of Teleph. fuscus *Linn.*, and has figured it in its different states; the larva (*fig.* 27. 16.) is long and fleshy, depressed, and of a velvety black colour, with an exposed scaly flat head (*fig.* 27. 18., upper side of the head transversely divided by a ridge into two parts, at the lateral extremity of which are the eyes; *fig.* 27. 17. the under side of the head), furnished with stout mandibles, two short antennæ (*fig.* 27. 19), and four palpi, with a single ocellus behind each antenna. Each of the first three segments is furnished with a pair of scaly legs, terminated by a curved hook, and the under side of the terminal segment, which is entire and rounded, is furnished with a fleshy tubercle, answering the purpose of a leg. The other segments are rounded at the sides. These larvæ

Belanger. Voyage de Duperrey.
Boisduval. Voyage d'Urville.
Perty. Del. An. Art. Brasiliæ.
Brullé. Exped. Scient. de Morée.
Guérin. Icon. R. An. Insectes. —Ditto, Voyage de la Coquille. —Ditto in Ann. Soc. Ent. de France, vol. ii.

reside in moist earth, and are carnivorous in their habits, feeding occasionally, according to De Geer, upon their own species as well as upon earth worms. I have repeatedly found them creeping about footpaths, in moss, &c., in the winter and spring months. Mr. G. R. Waterhouse has given a very correct figure of the larva of Tel. rufus, with the details of the mouth, &c. (*Trans. Ent. Soc. Lond.*, No. 1. pl. 3. f. 3.): the second joint of the antennæ is remarkable for emitting two conical processes, the larger of which represents the terminal joint, and the smaller an additional spine (*fig.* 27. 19.). This larva agrees with that figured by De Geer. Like the Drilus, these insects pass the winter in the full grown larva state, changing to pupæ in April and May without previously forming any cocoon. The pupa presents no peculiar feature, except two small points at the extremity of the body. The perfect insect appears in two or three weeks. M. E. Blanchard has also figured the larvæ and pupæ of Telephorus fuscus and T. lividus, which closely resemble each other and T. rufus in structure (*Guérin, Mag. Zool.* pl. 168.).

In certain seasons, the snow in Sweden and in the mountainous districts of France has been observed by De Geer and others to be covered for a considerable extent with an immense number of the larvæ of these insects, together with a multitude of other living insects, and which have been supposed to have fallen with the snow, or been deposited in such situations by gusts of wind after violent tempests which have defoliated the firs and pine-trees. The larvæ, thus found, are supposed by Latreille to belong to species which would make their appearance in the perfect state at an early period of the year. M. E. Blanchard has, however, suggested that they had previously resided in the ground covered at the time by snow, through which they had crept for the purpose of obtaining a fresh supply of air. (See also *Bulletin des Sciences Naturelles*, August, 1829.) Dr. Hammerschmidt of Vienna read an account of the larva of Malthinus biguttatus at the Breslaw meeting of German naturalists; but I believe the description has not yet been published.

There are upwards of fifty British species of this family, none of which exceed three quarters of an inch in length: their colours are generally dull.

The genus Malthinus comprises the smallest species in the family, seldom exceeding one-sixth of an inch in length, and having the elytra generally tipped with yellow.

In the *Transactions American Philosoph. Soc.* (New Series, vol. iii.) is contained an interesting Memoir by Mr. Hentz upon the use of the maxillæ in the Coleoptera*, and which comprises some interesting details upon two North American species of this family (Canth. marginata and 2-maculata *Fab.*), forming the genus Chauliognathus *Hentz*, from the peculiar structure of the maxillæ (*fig.* 28. 2. head, and 28. 3. maxilla of Ch. marginatus), the extremities of which are capable of being protruded in the form of elongated, fleshy, and pilose setæ, those found in the latter species being described as twice the entire length of the maxillæ: the abdomen in these species is longer than the elytra; and the former species at least has a pair of vesicles attached to the second abdominal segment, as in Malachius. Neither of these species are predaceous, but are found upon flowers. The former lives long, and, when about to die, generally grasps the petal of a flower with its mandibles, in which position it may often be found dead and dry; the latter species appears later in the year, remaining until the first frost destroys the blossoms of thistles upon which it feeds, where Mr. Hentz had an opportunity of seeing it protrude its maxillary setæ in the same manner as the tongue of the Lepidoptera. I have received specimens of the former species from Dr. T. W. Harris of Cambridge (Massachusetts), in which the maxillary lobes are exserted to twice the length of the head, having been displayed by Mr. Hentz himself.

The fifth family MELYRIDÆ* is composed of insects belonging to the Linnæan genera Cantharis and Dermestes, having the body soft,

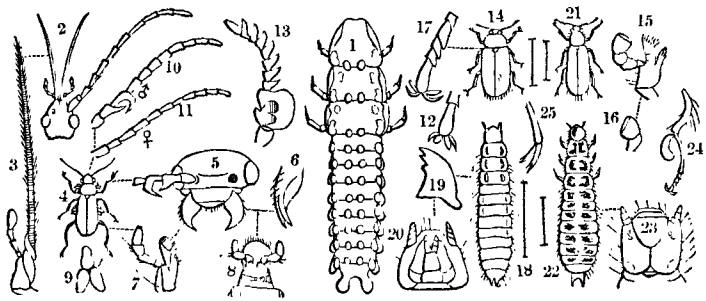
* Mr. Hentz regards the maxillæ merely as appendages of the tongue or labium, except in the Melolonthidæ and some other groups, in which their organisation evidently indicates some other use.

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* BIBLIOGR. REFER. TO THE MELYRIDÆ.

Fallen. (See Telephoridæ.)
Nov. Act. Soc. Sc. Upsal, vol. viii. and ix.
Mem. Acad. Sc. Stockh. 1799.
Germar. Insect. Sp. Nov.
Perty. Del. An. Art. Brasil. — Ditto, Coleopt. Ind. Orient. (Thesis, 1831.)
Brullé. Exped. Scient. de Morée.
Boisduval. Voyage de l'Astrolabe.

Fig. 28.



oblong, or ovate, and but slightly convex (*fig.* 28. 4. Malachius æneus); the palpi are short, filiform, and pointed at the tip; the upper lip is distinct and exserted (*fig.* 28. 5. front of the head, *fig.* 6. the mandible seen laterally, *fig.* 7. the maxillæ, and *fig.* 8. the labium of Malach. æneus); the head exposed; the thorax slightly convex; the antennæ moderately long, serrated, nodose, or pectinated in the males of some of the species (*fig.* 27. 10. antenna ♂, 11. ditto ♀, Mal. æneus; *fig.* 27. 12. extremity of tarsus of ditto.) These insects are generally of small size, and very active, being ordinarily found upon flowers for the sake of the insects which they find there and upon which they feed, the females not even sparing their partners if confined together. They are gaily coloured, green and red being their most conspicuous tints.

Some of the species of the British genus Malachius have the anterior angles of the thorax and the base of the abdomen (as in *fig.* 28. 4.) furnished with several red bladder-like appendages (*fig.* 28. 9.), which the insect is able to contract or dilate at will, the precise use of which is not known. Mr. Curtis thinks they may enable the insect to increase or decrease its gravity during flight; but Messrs. Kirby and Spence regard them as being employed for the purpose of alarming their enemies and showing their rage, as they are retracted as soon as the cause of alarm is removed. I should rather consider them as a portion of an apparatus for emitting an offensive effluvium for the like purpose.

Guérin. Voyage Duperrey. — Ditto, Iconogr. Règne Animal. — Ditto, Voyage de la Coquille.

Bull. Soc. Nat. Moscow, vol. vi.

Fabricius, Olivier, Gyllenhall, Stephens, &c.

The males of M. marginellus *F.* (bispinosus *Curt.* ♂) and some others have a hook-like tubercular process at the extremity of the elytra, which Latreille states is seized by the mandibles of the other sex in order to prevent its escape. As, however, it is the male which is thus armed, and as Mr. Stephens has ascertained that both sexes of another species (M. bituberculatus) and also M. binotatus *Bab.* exhibit this structure, I should think that Latreille's statement is scarcely correct. I have published some further observations on this subject (*Mag. Nat. Hist.*, vol. vii., and see *Ent. Mag.* vol. iv. p. 365.).

The larva of Malachius æneus has been observed by Dr. Hammerschmidt; but his description of it has not yet been published. Mr. George Waterhouse has published a description and figure of the larva of Dasytes serricornis *K.* (*fig.* 28. 22., *fig.* 23. head of ditto, *fig.* 21. Dasytes æratus), which is of an elongate form, soft, pubescent, and gradually swelling towards the apex, which is furnished with a pair of acute spines. Its colour is whitish, variegated with markings of a dull green hue, and it is found early in March in decayed blackthorn and pear trees, in company with the pupa. The imago appeared in April (*Entomol. Mag.*, vol. ii. pl. 10. f. 1.). M. Audouin has informed me that he has reared Dasytes plumbeus from the larva, which is of a brownish colour, with dark spots, and which is found in the wood of lime trees. Latreille considers that the larvæ of this genus are carnivorous. The males of some of the species of Dasytes (genus Enicopius *Steph.*) have the hind leg singularly contorted (*fig.* 28. 24.): the penultimate segment of the abdomen is also notched in the males of all the species, and the terminal segment often armed with particular appendages.

The species of the genus Aplocnemus *Steph.* (Elicopis *Besser*) appear to recede from the others in their habits, the typical species A. impressus *Marsh* (*fig.* 28. 14., *fig.* 15. maxilla, *fig.* 16. labial palpus, *fig.* 17. tarsus of ditto), being found under the bark of trees, in which situation (in elm trees) the larva (*fig.* 28. 18.) has been found by Mr. G. R. Waterhouse during the winter. It is nearly half an inch long, of an elongate, depressed form, and fleshy consistence, and clothed with hairs; the head (*fig.* 28. 20., *fig.* 19. one of the mandibles), prothorax, and terminal segment being coriaceous; the meso- and meta-thorax having also a pair of lateral black coriaceous patches; the last segment is armed with a pair of obtuse corneous points. Its colour varies from white to purple (*Trans. Ent. Soc.*, vol. . pl. 6.).

The family comprises several distinct types, of which the G. Malachius most nearly approaches the Telephoridæ in habits and general appearances, whilst Dasytes is evidently closely allied to the Cleridæ in the structure of its larva.

The exotic genera are few, and exhibit no remarkable features, with the exception of that which I have proposed for the reception of the Paussus flavicornis *Fab.* (Megadeuterus *Westw.*), which has the second joint of the antennæ immensely swollen (*fig.* 28. 13.), and a singular species of Dasytes from Colombia of large size, for which I am indebted to M. Gory, in which the elytra of the male are distended into a spherical balloon. In some of the large Brasilian exotic species, which Dejean still retains under the generic name of Dasytes, the tarsal ungues are deeply notched at the tips (*fig.* 28. 25.), but as the genus was originally proposed for the small European species it will be necessary to form these exotic species into a new genus.

The sixth family, CLERIDÆ * *Westw.*, is of small extent, and composed of various insects placed by Linnæus in his genera Attelabus, Chryso-

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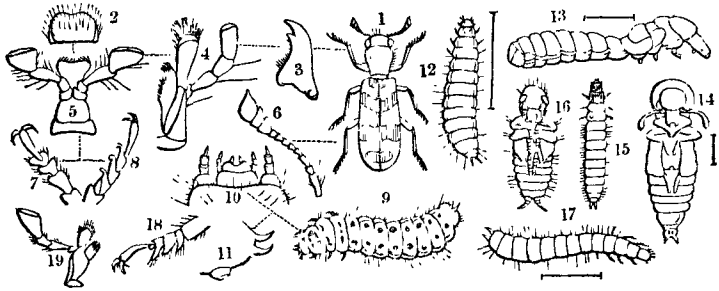
* BIBLIOGR. REFER. TO THE CLERIDÆ.

Kirby. Trans. Soc. Linn. Lond. vol. xii.—Ditto, in Zool. Journ. vol. ii.
Guérin. Iconograph. Règne Animal. Ins. pl. 15.
Klug, in Descr. Ins. Madagascar.
Griffith. Animal K. Insects, pl. 48.
Fischer and Steven, in Bull. Mosc. 1829.
Sturm. Catalog. Meiner Ins. Samml. — Ditto, Deutchslands Fauna, vol. xi.
Germar. Ins. Spec. Nov.
Perty. Delect. An. Art. Brasiliæ.
Dalman. Anal. Ent.
Brullé. Exped. Scientif. de Morée.
Say. Amer. Entomol.
Nov. Act. Soc. Roy. Upsal. — Mem. of the Nat. Hist. Soc. Berlin, vol. v. — Act. Holm. 1825.
Charpentier. Horæ Ent. t. vi.
Hope, in Trans. Zool. Soc. Lond. vol. i. —Ditto in Trans. Ent. London, vol. ii. — Ditto in Pettigrew's Work on Mummies.

mela and Dermestes, having for its type that of Clerus*, of Geoffroy, a name proposed long before Olivier employed that of Tillus for the same insects, although the latter name has been adopted by Leach and others for the family name of the group; indeed, Dejean, by overlooking the fact that the Attel. apiarius *Linn.*, was Geoffroy's typical species, and by employing for an allied group the name of Notoxus, has introduced great confusion in the names of the groups, which may be corrected by adopting the nomenclature given in my synopsis.

The family is distinguished from the preceding by the greater firmness of the body, which is long and often cylindric, with the head

Fig. 29.



and thorax narrower than the elytra (*fig.* 29. 1. Clerus alvearius), and by the short antennæ, which are sometimes filiform and serrated, and sometimes gradually, or abruptly clavate (*fig.* 29. 6.). The palpi, or at least one pair of them, are terminated by a large hatchet-shaped joint (*fig.* 29. 4. maxilla, 29. 5. labium of Clerus, 29. 19. maxilla of Opilus); the mandibles have several teeth (*fig.* 29. 3.); the upper lip is distinct (*fig.* 29. 2.); the tarsi are short, broad, and often spongy beneath, with at least one of the joints, often the penultimate, bilobed; the basal joint is occasionally scarcely distinct (*fig.* 29. 7. tarsus of Clerus, 29. 8. ditto, seen laterally, 29. 18. tarsus of Necrobia); the head is retractile in the thorax as far as the eyes, which are generally lunate.

* This name was indeed very aptly selected for these insects, since, although Geoffroy does not appear to have been aware of it, it was employed by ancients (as recorded by Aristotle) for a worm, which was found in bees-hives, probably however, as suggested both by MacLeay (*Horæ Ent.* p. 436.), and Latreille (*Cours d'Ent.* p. 63), it might have been that of Galleria Cereana, indeed Latreille considers that the larva of the Clerus was the Pyraustes of the Greek naturalist, which produced the Prasocuris.

These insects which seldom exceed an inch in length, and are generally handsomely variegated in their colours, frequent flowers; others, however, are found upon and under the bark of old trees, stumps, dry wood, &c., where they have passed the larva state, during which period, as far as has been hitherto observed, they are carnivorous.

The species of the genus *Clerus* are amongst the largest of the family; having the elytra generally of a bright red colour, ornamented with purple spots or fasciæ. They frequent flowers, the honey of which they extract by means of their beautifully ciliated maxillæ; but in the larva state they are very destructive to bees and wasps, in the nests of which the females deposit their eggs, during the absence of those insects, upon whose grubs the larvæ of the Clerus, when hatched, prey; the C. apiarius selecting the hive bee, and the C. alvearius (*fig.* 29. 1.) the mason bees (Osmia and Megachile). The larvæ (*fig.* 29. 9.) are of a beautiful red colour. Mr. Stephens describes those of C. alvearius as having a bluish spot on the scutellum; Latreille, however, from whom this description is derived, alludes to the spot near the scutellum of the imago (*Règne An.*, first edition, 3. 256.). The upper lip is distinct and emarginate, and the antennæ 4-jointed (*fig.* 29. 10.). They are furnished with six scaly legs, and two corneous points at the extremity of the last segment of the abdomen, which has also a fleshy retractile proleg on the underside (*fig.* 29. 11.). Schrank was of opinion that the Clerus deposits its eggs in the flowers frequented by bees, which conveyed them into the nest with the pollen; but such a mode of oviposition is inconsistent with the great care shown by female insects in selecting the most proper places for the reception of their eggs. The larva, when hatched, first devours the grub of the bee in the cell in which it is born, and then proceeds from cell to cell, preying upon the inhabitant of each until arrived at maturity. It is in this situation, also, that it undergoes its changes in a small cocoon, which it has previously constructed, making its escape from the nest in the beetle state, when the hardness of its covering sufficiently defends it from the stings of the bees. Swammerdam was the first author who described the habits of these beetles, having found the larva, or, as he calls it, a red worm, in the nest of a mason bee. This worm, figured by him (*tab.* 26. f. 3. *a.*), changed into a nymph (*b*). " But this nymph, after (in) the space of a whole year, did not change into a bee, but into a very beautiful beetle; nor

could I, in the mean time, observe that this worm (pupa) in all this time took any considerable food, unless, perhaps, the stony and clayey particles of its nest served it for food." (P. 226.) Réaumur (*Mém.* 3. vol. 6.) has given an account of the ravages of this insect, and Schaeffer has also described it, and given magnified figures of the larvæ and its details, and which resembles the larvæ of Opilus (*Abhandlungen von Insecten*, vol. 2. t. 5.).

During a visit, in company with Messrs. Audouin and Brullé, to the Parc de Belle Vue, in the month of July, 1837, we discovered a number of the nests of Megachile muraria (a large black mason bee) upon a stone wall, with a south aspect. With the greatest difficulty, owing to their hard stony composition, we detached some of them, and in the interior of several we found the larva of a Clerus (*fig.* 29. 9.), devouring the larvæ of the bees, passing from cell to cell. One of these larvæ, which I am now endeavouring to rear to the imago state, has exhibited similar habits to those described by Swammerdam; but the other, for want of its natural food, has burrowed into a piece of cork, upon which it feeds.

M. Al. Lefebvre has published an account of a small species belonging to this family, which he names Clerus Buquet, found by him, in its different states, in the pith-like roots of Eschinomena paludosa, which are used to line insect-cases coming from India. He has described and figured the larva and pupa; the latter of which (*fig.* 29. 14.) was enclosed in a cocoon. The former (*fig.* 29. 13.) varies very considerably in its structure, as represented by M. Lefebvre, from the larva of Clerus apiarius; but the specimen was dried and shrivelled up, as well as much damaged. He has had the kindness to present me with his specimens of the insect in its various states. Upon examination it appears to me that this species belongs to a distinct genus, intermediate between Thanasimus and Necrobia. The parts described as the eyes of the larva are evidently the basal joint of the antennæ, the remainder of which is broken off; the true eyes are very minute and granular, inserted behind the antennæ, there being several on each side of the head, which is oblong and flat; the legs appear to be all injured, one anterior femur alone remaining; the thoracic segments are much contracted, with several transverse channels, the specimen being probably on the point of assuming the pupa state. The extremity of the body is obliquely truncate at the eighth abdominal segment, which is covered by a black horny plate. I could not ascertain whether

the extremity of the body was not injured, or merely shrivelled up. The body of the pupa is terminated by two points. Several small beetles, with their larvæ and pupæ, were found in company with this Clerus, upon which it probably subsisted (*Annales Soc. Ent. France*, 1835, plate xvi. p. 584.)

Mr. G. R. Waterhouse found several larvæ in rotten whitethorn wood, in Kensington Gardens, during the winter months, in company with those of Anobium tesselatum, agreeing in structure, although some were of a yellowish white colour, spotted with pink; whilst others were entirely pale pink above and pale yellow beneath. The former he considered to be those of Thanasimus formicarius, and the latter of Opilus mollis. As these larvæ (for one of which I am indebted to Mr. Waterhouse) did not appear to bore into the wood, it seems probable that they fed upon the larvæ of the Anobium. Subsequently he has published a description of the pink larvæ, which remained two years in the larva state (although it appeared to be full-grown when captured), previous to assuming the pupa state, from which, however, it soon emerged as Opilus mollis, as he had surmised. This larva (*fig.* 29. 12.) is about half an inch long, of a soft consistence, and covered with long rufescent hairs. The legs are short, and the extremity of the body terminated by two corneous diverging protuberances. The mandibles are short, stout, and unidentate (*Trans. Ent. Soc. Lond.* No. 1. pl. 5. *fig.* 1.) These larvæ are also found in dry and rotten willows, beneath the bark of which the perfect insects are also found. Latreille states that they are also found in houses, feeding upon the larvæ of other insects.

Mr. Dale has recorded (*Mag. Nat. Hist.* No. 19.) the capture of the larva of Tillus ambulans in rotten oak, on the 8th of May, and "which was bred on the 11th," from which it would appear, that it required only three days to undergo its change in the pupa state. I think, however, that some error must have crept into this statement. Latreille mentions a curious instance of tenacity, in a specimen of Tillus elongatus *Linn.* which had seized his finger with its jaws, and which suffered its head to be pulled off rather than quit its hold. The Thanasimus formicarius (so named from its resemblance to an ant) is found upon rotten or newly felled trees, especially those of fir, under the bark of which the larva, according to Linnæus, resides, devouring the larvæ of the timber-boring Anobium.

Dr. Ratzeburg has more recently published an account of the

habits and a description of the preparatory states of Thanasimus formicarius, in his "*Forst. Insecten,*" pl. 1. f. 17. The larva (*fig.* 29. 15.) is of a dark pink colour, with a pitchy head and prothorax, and two pitchy spots on the meso- and meta-thorax. In its form, it closely resembles Clerus; it feeds upon lignivorous larvæ, having been detected by Saxesen and Hartig, in the cocoons of Hylobius notatus and Hercyniæ: its pupa is represented at *fig.* 29. 16.

The species of the genus Necrobia, as the name implies, depart from the typical habit of the family, by feeding upon carrion and dead animal matter, such as dried skins, old bones, &c., both in the perfect and larva state; the latter, according to Geoffroy, resembles that of Clerus apiarius, having the body elongated, soft, with six scaly legs, and two hooks at the tail. To one of the species of this genus (N. ruficollis), entomologists are indebted for the preservation of the life of Latreille. Scarcely needed this celebrated man, who, by his numerous and highly valuable works, has raised the science to the high rank which it now holds, to apologise for the introduction of the statement of this fact, which, from its singularity and the interest which must attach to it, I doubt not will be acceptably received in his own words: "A l'époque de ces jours affreux que firent éclore en France et l'ambition de quelques hommes et le fanatisme révolutionnaire, je trouvai l'insecte que je viens de décrire à Bordeaux, sur les murs de la prison où j'étois detenu. Renfermé dans un bouchon de liege cacheté, et envoyé à Bory de Saint Vincent, cet insecte devint l'occasion de ma délivrance," (*Hist. Nat., &c.*, vol. ix. p. 157.). M. Brullé has given a full narrative of this interesting event in his *Hist. Nat. des Insectes Col.* vol. iii. S. S. Saunders, Esq., M. E. S. also found the same insect in profusion upon the walls of the Penitentiary, Westminster.

I observed specimens of the same insect both in the larva and imago state, in company with a great quantity of Dermestes vulpinus, which had destroyed a cargo of cork (communicated by Mr. Bowerbank to the Entomological Society). It is impossible, however, to decide whether the Necrobia had fed upon the cork, or whether its larva had attacked those of the Dermestes. The larva (*fig.* 29. 17.) is of a much more elongated and anteriorly attenuated form than the other larvæ of the family yet observed. In the 14th volume of the *Linnæan Transactions*, an account is given of some insects found on opening a mummy, amongst which were specimens of

Necrobia violacea; and the Rev. F. W. Hope has described a species of this genus of a reddish colour, under the name of Necr. mumiarum, in Mr. Pettigrew's work upon mummies. He is of opinion, that the medicaments used in the process of embalmment might partially have discharged the colour of the beetles, some having a purple tinge. M. Champollion Figueac has also published a note respecting the same or a closely allied species found in a mummy, and described by Jurine under the name of Corynetes glaber (intermediate between rufipes and abdominalis), *Magasin. Encycloped.*, Paris, May, 1814.

The genus Corynetes *Fab.* is very nearly allied to Necrobia, with which it is often confounded; the species are found upon flowers and in hedges as well as in houses. The following observations upon Cor. violaceus, made by the late General Hardwicke, have been published byMr. Curtis: — "When at Wisbeach, in October last, my attention was drawn to the depredations going on in the plank of a deal box, in which I found the larvæ of a small Coleopterous insect (Cor. violaceus) embedded in dust, which their little jaws had produced between the upper and lower surfaces of the plank; I found, also, in the same dust, the cocoon of the pupa of some of the larvæ, of a soft, silky, leathery texture, not unlike what are formed by the clothes-eating moths when the larva assumes the pupa state. In this cocoon there appeared to be three cells, two of them unoccupied, the third closed and full; I therefore enclosed the cocoon with the bit of plank in a box, to secure the insect, when it might become an imago, which occurred about six days after." (*Brit. Entomol.* fol. 351.). As however we have already seen that the larvæ of some of these insects prey upon the wood-boring Anobia, and as no species has been ascertained to feed naturally upon (although found in) wood, I feel inclined to regard this communication as relating to two distinct insects, the previous part to an Anobium, and the latter to a Corynetes, which had destroyed the other, and the account of the two empty cells seems to confirm such an opinion.

Amongst the characters given by Mr. Curtis, separating Necrobia from Corynetes, are especially mentioned the 4-jointed tarsi, and the posteriorly angulated thorax in the former, but in N. Mumiarum (which I carefully examined, and figured in Mr. Pettigrew's work), I observed five joints in the tarsi, the fourth being small, and the thorax posteriorly rounded at the angles.

The exotic genera scarcely present any material characters for observation; the Brazilian genus Stigmatium cicindeloides *Hope* (*Griffith, An. K.*) having the aspect of a Cicindela, with very slender antennæ and prominent eyes, and Enoplium (Chariessa *Perty*, placed by that author amongst the Chrysomelidæ), and having the antennæ terminated by three large internally produced joints, being the most interesting. The splendid Brazilian Opilus auripennis *Hope* (*Zool. Trans.* i. pl. 13. f. 5.), appears to form a distinct subgenus *, having the antennæ similar to Enoplium; but the thorax is very different, and the tarsi are completely tetramerous, whilst some species (genus Stilpnonotus *Gray, An. K.*) are as perfectly heteromerous, the four anterior tarsi being 5-jointed, and the posterior pair 4-jointed.

The seventh family, PTINIDÆ †, corresponds with the Linnæan genus Ptinus, and comprises a rather extensive group of insects of small size but of very destructive habits. The body is of a firm consist-

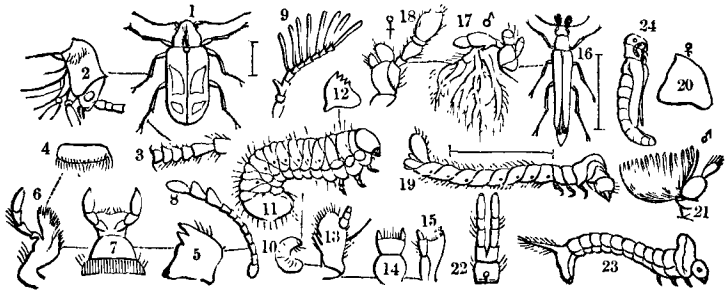
* The Enoplium viridipenne *Kirby* appears congenerous.

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Stephens, Fabricius, Olivier, Gyllenhall, &c.

Fig. 30.



ence, and of an oval or subcylindric form, but generally short and obtuse at each end (*fig.* 30. 1. Ptinus imperialis). The head is small, and immersed into the thorax as far as the eyes; the antennæ moderately long, filiform, serrated, or pectinated, (*fig.* 30. 9. antenna of Ptilinus ♂.) or rather short, with the last three joints large and compressed (*fig.* 30. 8. antenna of Anobium). The thorax is broad in front, serving as a hood for the head over which it is produced (*fig.* 30. 2.); the upper lip is transverse and entire (*fig.* 30. 4.); the mandibles are small and dentate at the tip (*fig.* 30. 5. mandibles of Anobium tesselatum); and the palpi are short, and terminated by a rather incrassated joint (*fig.* 30. 6. maxilla, 30. 7. labium of Anobium). The tarsi are 5-jointed, and occasionally very broad (*fig.* 30. 3. tarsus of Ptinus imperialis). The colours of these insects are obscure, or but little variegated; when touched, they counterfeit death by withdrawing their head and antennæ, and contracting their legs; and so pertinacious are they, that they will suffer themselves to be pulled in pieces, or even, as has been asserted, roasted before the fire, rather than offer any signs of life. Their movements are slow, and it is not often that they make use of their wings; they are found in old houses, in furniture, and in rotten palings, stumps of trees, &c., which they and their larva perforate with round holes, in every direction, which are filled with a very fine powder, formed of gnawed wood and excrements. Some species (as Anobium paniceum, pertinax, &c.), feed upon collections of dried plants, skins of insects, &c.; whilst others (An. striatum) bore into our chairs, tables, and other wood-work, books, &c., in the larva state, from which they escape on arriving at the perfect state, sometimes in such numbers, as to render the furniture attacked completely rotten; of which an instance is recorded by me

in the *Transactions of the Entomological Society*, p. viii., concerning Ptilinus pectinicornis, myriads of which completely destroyed a new bed-post in the short space of three years. Mr. Spence has also given an account of the great injury produced in the timbers of houses, at Brussels, by Anobium tesselatum (*Ent. Trans.* vol. ii. p. xi.). In the third volume of *Illiger's Magazin.*, there is a memoir by Von Malinousky, on the destruction of these beetles. Some species, including A. paniceum, &c., feed upon almost every substance, devouring ginger, rhubarb, cayenne pepper, black wafers, &c., even perforating tinfoil in the larva state, and rendering ship biscuit unfit for use by feeding and breeding in it in great profusion. The last-named insect has also been known to devour even Cantharides; I have also often found it in the bodies of old specimens of insects; it is also very troublesome where quantities of wafers are kept, feeding upon them and fastening them together in masses of three or four, within which it undergoes its transformations. Ptinus fur will also feed upon old woollen clothes; it also feeds upon wheat deposited in granaries, committing great devastation, as we learn from some observations of M. Audouin, published in the *Ann. de la Soc. Ent. de France*, 1836. p. lxii.

Some of these insects (Anobium striatum, tesselatum, &c.) are also the cause of occasional alarm to ignorant persons, from the noise which they make during the season of pairing, by striking their jaws upon the object upon which they are stationed, by way of signal, and which is replied to in the same manner by the other sex. Hence these insects have acquired the vulgar name of the Death Watch; the noise somewhat resembling the ticking of a watch, and being regarded as a superstitious omen.

> "The solemn death-watch click'd the hour she died."
>
> GAY.

Mr. Dillwyn, in his *Swansea Coleoptera*, states, that the same opinion also prevails in Wales; the insect being termed by the Welsh "Mawr orearw;" but he thinks the name is also given to the Termes pulsatorius. From a lengthened series of observations which I have made upon this subject (see *Mag. Nat. Hist.* Sept. 1834.), I am inclined to believe that the same noise is also produced by the larvæ, whilst gnawing the wood upon which it feeds. Olivier thought it was also produced by the larvæ, but that it was occasioned by the blows which they made, in order to ascertain the thickness of the wood which still remained unbored, before they could reach the surface.

These larvæ very much resemble those of the Lamellicorn beetles in miniature, being soft, cylindric, fleshy, and slightly pilose, with a scaly head, and six legs, and with the last segment large, not furnished with any appendage, and curved beneath the body (*fig.* 30. 10. larva of Anobium, natural size, 30. 11. ditto magnified), so that the insect cannot walk upon a flat surface. The jaws (*fig.* 30. 12.) are robust, and armed with four obtuse teeth; the other parts of the mouth are short; the maxillæ are terminated by a rounded and strongly ciliated lobe; the maxillary palpi are short and 3-jointed (*fig.* 30. 13.); the lower lip is thick, with short, apparently inarticulated palpi (*fig.* 30. 14., 15. ditto seen laterally); and the antennæ are obsolete. The larva of Anobium paniceum, communicated to me by Mr. Stephens, is white and curved, and similar to those of the Ptini, and other Anobia.

When full-fed, they construct a cocoon of soft silky matter, mixed with the substances upon which they have been feeding, within which they are transformed to pupæ. It would appear that the larva has the instinct to continue the boring of its burrow until it has nearly reached the surface, so that a slight barrier only remains, which the perfect insect can pierce without difficulty. Linnæus informs us that these mischievous grubs may be destroyed by means of arsenic and alum. The perfect insects generally appear in the hottest parts of the summer.

De Geer (*Mém.* vol. 4. pl. 9.) has given an account and figures of the larva of Ptinus fur. Bouché (*Naturg. der Ins.* p. 187.) has described those of Ptinus imperialis and Anobium tesselatum. Goeze (*Naturforscher. St.* 8.) has given a long account of two larvæ belonging to this family. The larva of another species is described in the new *Transactions* of the Swedish Academy (1783. 8. 239.); and Mieneken has published an account of that of Ptinus fur in the *Naturforscher. St.* 3.

The species of the genus Ptinus are found upon old and decaying timber; and Latreille states that he has frequently found Ptinus germanus upon excrement. The sexes in this genus vary so materially in form, that they have often been described as distinct. The males are long and narrow, and the females short and thickened. The Ptinus imperialis *Linn.* (*fig.* 30. 1.), one of the largest and most elegant British species, is referred by Latreille to the genus Hedobia *Dej.*, as it recedes in habit from the rest of the species; having the antennæ

wide apart at the base, and the tarsi broad and cordate (*fig.* 30. 3.). I have always found it in whitethorn hedges. Ptinus latro and P. crenatus have been observed to attack collections of insects. (*Ann. Soc. Ent. Fr.*, 1836, p. iv.)

The curious genera Mezium and Gibbium might almost be mistaken for drops of blood. I once found a considerable number of the *Mezium sulcatum* in an old opera-hat. The following observations upon the same insect were communicated to me by Mr. Davis, by whom it was found in the dead bodies of decayed insects. One was observed in the pupa state between the abdomen and elytra of a beetle, the interior of the body of which had been partially consumed by the larva, which resembles those of the other species of the family; and the pupa is inclosed in a cocoon formed of silky matter, mixed with the excrements of the larva.

M. V. Audouin (*Ann. Soc. Ent. France*, 1835, p. v.) recently discovered an innumerable quantity of the *Gibbium scotias* in a small antique vase, dug up at Thebes, in which a small quantity of semifluid resinous matter was also contained. He is inclined to believe that the insects (for one of which I am indebted to him) had been attracted to this matter at a subsequent period, rather than that they had been embalmed in it by the Egyptians. Mr. Wilkinson, the distinguished Egyptian traveller, has also informed me of a similar discovery made by himself.

The species of *Ptilinus* reside in dry rotten wood, piercing it in every direction with their cylindrical burrows: it is in this situation, also, that the union of the sexes takes place; the male remaining on the outside, and suspended in the air.

The only British species of *Ochina* is found upon ivy, in which the larva resides. I have received it from Germany, under the name of Ochina Hederæ *Germar.* A. Cooper, Esq., R.A., has informed me that he has found it upon the trunk of a crab tree, clothed with ivy, in considerable numbers, and that it is preyed upon in the larva state by Cleonymus depressus.

The *Lasioderma testaceum* ought probably to be regarded as a doubtful inhabitant of this country. I have reared it from a larva found feeding upon gum sumach, which it occasionally deteriorates to a considerable extent. The larva is small and white, and resembles those of the other species. I have also found it in the decayed body of a Squilla; and Mr. Hope has captured many specimens in his

library in London, crawling upon the ceilings, where it had probably escaped from the decayed bodies of some of his exotic insects.

M. V. Audouin has communicated to me some observations upon a new species of *Dorcatorna*, which he reared from a small larva, discovered feeding upon a subcortical species of moss.

The *Anobium tessellatum* is the largest British species belonging to the family. I have reared it from larvæ found in rotten whitethorn wood, in which it has remained more than three years before it arrived at the perfect state. I have represented its larva at *fig.* 30. 11.; Dr. Ratzeburg has also published a figure of this larva in his *Forst-Insecten*, pl. 2. fig. 19. B. M. Dufour has published a valuable memoir on the internal anatomy of this genus. (*Annal. Scienc. Nat.* 1828.)

The *Dryophilus anobioides* was first discovered by me, many years ago, near London. It has since occurred at Coombe Wood, upon the broom, in the spring. I have published some observations upon it in the *Entomological Magazine* (vol. ii. p. 112.).

The exotic genera of this family do not present any material features worthy of comment.

The eighth family, LYMEXYLONIDÆ*, corresponding with the Fabrician genus Lymexylon, is composed of some of the most remarkable Coleopterous insects hitherto discovered. It is of small extent, and comprises those serricorn beetles which have the head separated from the thorax by a narrow neck; the prosternum is not produced into a point behind; the mandibles short, thick, and obtusely bidentate (*fig.* 30. 20. mandible of Hylecœtus ♀.); the body is linear, and of a moderately soft consistence (*fig.* 30. 16. Lymexylon navale ♂); the antennæ are short, and the maxillary palpi of the males are furnished

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with very remarkable appendages, of which the uses are entirely unknown (*fig.* 30. 17. maxilla of the male from Curtis; 30. 18. ditto ♀); the labial palpi are simple (*fig.* 30. 22. labium of Hylœcetus ♀). The species in the larva state feed upon wood.

It has been already stated that Latreille (*Règne Anim.* 2d edit.) raised this family to the rank of a primary section of the Serricornes, under the name of Xylotrogi, placed after the Ptinidæ, on account of the disengaged head; a character which can scarcely be regarded of sufficient value to warrant such a step. Dejean, on the contrary, united them with the Ptinidæ, forming them into a section, Terediles, evidently from the similarity in their wood-boring habits. That these insects are of difficult location cannot be denied; but the five-jointed tarsi, and the structure of the trophi of the female, which is not very different from that of some of the Lampyridæ, point out a much stronger affinity with the Malacodermous insects than with the Cantharidæ, with which they have been recently associated by British entomologists: indeed, they even seem to be more nearly related to the Helopidæ, and still more to Melandrya, both in their habits and the structure of the mouth (especially the maxillary palpi of the female), than to the Cantharidæ.

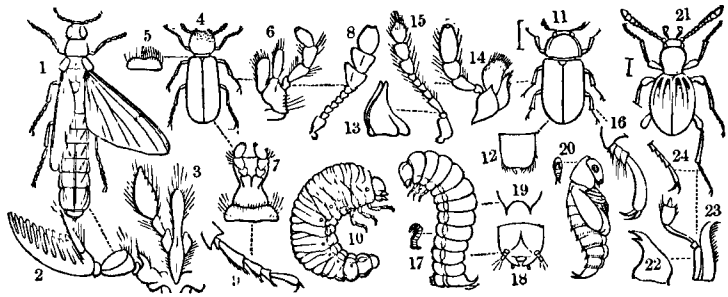
The family strictly comprises but the genera Lymexylon, Hylecœtus, and Atractocerus, of which the first two are British. The only British specimen of Lymexylon navale (*fig.* 30. 16. ♂) hitherto discovered, was captured by Mr. J. H. Griesbach, in Windsor Forest, on an oak tree, in July, 1829. The third joint of the maxillary palpi of the male emits numerous long and pilose branches, like a piece of coral (*fig.* 30. 17.): the palpi of the female are simple (*fig.* 30. 18.). This very curious insect is very common in oak forests in the north of Europe, the timber of which it perforates and greatly injures; it is, indeed, occasionally so abundant in the dockyards of France and Sweden as to cause much damage. Linnæus, at the suggestion of the King of Sweden, having investigated and ascertained the real cause of this damage, suggested that the timber should be sunk under water at the time the insect made its appearance in the perfect state, whereby it was secured against its attacks. Linnæus's account of this insect is published in his *Iter Westrogoth.* accompanied by figures (p. 153. t. 2. f. 2—4.). Dr. Ratzeburg has published an account of the injuries committed by this insect (*Die Forst-Insecten Kafer*, vol. i.), accompanied by figures of the larva and perfect insect: the former

is very long and slender, with the first segment after the head dilated into a large hood, and the terminal segment produced into a large obtuse lobe (*fig.* 30. 19.) copied from *Ratzeburg*, tab. 2. fig. 23. B.

The genus Hylecœtus comprises the Cantharis Dermestoides *Linn.*: a long reputed British species also distinguished by the remarkable filamentous structure of the third joint of the maxillary palpi in the males (*fig.* 30. 21. maxilla ♂). It is found in oak trees, which it perforates in the same manner as the preceding. M. T. Desvignes, however, who recently discovered the species in Sherwood Forest, and to whom I am indebted for a specimen, saw them flying round one of the old birch trees, upon which they alighted, and then ran quickly up and down the bark. Its larva, copied at *fig.* 30. 23., from *Schellenberg's Entomologische Beytrage. Winterthur*, 1802. 4to. tab. 1.; (a work of great rarity, and which I have been only able to meet with in the library of the Natural History Society at Berlin) has a remarkable protuberance, or hunch, upon the first segment, and a long horn upon the back of the terminal one. Its pupa, from the same work, is represented at *fig.* 30. 24. Sturm has given another figure of this larva (*Deutchsl. Faun.* v. xi.); and, more recently, Dr. Ratzeburg has published figures of the same insect in its different states (*Die Forst-Insecten*, vol. i. tab. 2. f. 25, 26., with details). The pupa of H. barbatum, also figured by Schellenberg, is similar in form, but the elytra are shorter. The same author has also represented the details of these species. Bechstein and Scharfenburg have likewise published a long account of the economy of this genus (*Vollstandige Naturgesch. der Schadlichen Forst-Insect. Leipz.* 4to. 1805.). Dr. Perty (*Delect. Animal. Articul. Bras.* pref. p. 8.) states that the largest species of this genus (H. brasiliensis *Dej.*) is found upon fungi, in which it forms long cylindrical burrows; and that H. cylindricus *Dej.*, which varies greatly in size, enters at night into houses, being attracted by the lights.

The exotic genus Atractocerus is remarkable for the very minute size of the elytra, leaving the wings exposed, and not so long as the flattened abdomen (*fig.* 31. 1. Atractocerus from Brazil). It comprises very few species, the type being the Necydalis brevicornis *Linn.* The typical species is presumed, by M. Palisot de Beauvois, to reside in wood; but Perty informs us that the habits of A. brasiliensis are similar to those of Hylecœtus cylindricus, mentioned above. The

Fig. 31.



maxillary palpi, in one sex, which, from analogy, may be considered as the male, are singularly developed* (see *fig.* 31. 2. maxilla; 30. 3. labium); but the abdomen in these individuals is terminated by an elongated, flattened, and attenuated instrument, similar to that possessed by the female Cerambycidæ, &c., for the purpose of depositing their eggs. The sexual differences have not hitherto been noticed, although Dr. Perty states that the males are much rarer than the females of the Brazilian species. Latreille mentions an individual preserved in amber, or, perhaps, more probably, gum animé, in the collection at the Jardin des Plantes.

The genus Rhysodes *Latr.*, which has been placed in this family, together with Clinidum *K.*, appear to me to be intermediate between Parandra, Passandra, on the one hand, and the Brentidæ. They are also closely allied to some of the Cucujidæ, as I have endeavoured to prove in a memoir upon these insects, inserted in the *Zoological Journal*, No. 18. Perty states that two Brazilian species of Rhysodes are found under bark and in rotten trunks of trees.

The anomalous American genus Cupes (of which I have published the characters of a second species, *Zool. Journ.* No. 20.) has also been referred to this family by Latreille. Its general appearance and characters are, however, widely distinct from those of the true Lymexylonidæ.

* The hirsute slender appendage, arising from the base of the flabellate portion of the palpi (and which Messrs. Kirby and Spence regarded merely as an appendage of the terminal joint) appears to me to correspond with the terminal joint itself, the flabellate portion being the extraordinarily developed third joint: this opinion is confirmed by the analogy exhibited between the palpi of Atractocerus and Lymexylon.

The ninth family, BOSTRICHIDÆ*, is of small extent, and distinguished by the cylindrical form of the species; the thorax obliquely truncate in front, forming a hood over the head (*fig.* 31. 4. Bostrichus capucinus); and the antennæ short and 10-jointed, with a 3-jointed perfoliated clava (*fig.* 31. 8.); the parts of the mouth are robust, and fully developed; the upper lip distinct and hirsute (*fig.* 31. 5.); the maxillæ with two lobes (*fig.* 31. 6.); and the labium elongated, with a short, transverse, and pilose mentum (*fig.* 31. 7.); the tarsi (*fig.* 31. 9.) are composed of five simple joints, the second and fifth being of equal length; the basal joint is very minute, but is quite conspicuous in the large exotic species. These insects are found upon the trunks of old trees, upon the wood of which the larvæ subsist.

This family was placed by Latreille in the Tetramerous group Xylophaga, between the Curculionidæ and Cerambycidæ. Mr. Stephens, however, makes them the connecting link between the Ptinidæ and Curculionidæ, with the assistance of the Scolytidæ, which, as it appears to me, he inappropriately places in this family; since, although, in some respects, Bostrichus may be allied to Scolytus, yet here the perfection of the trophi, and the possession of legs by the larvæ in the former genus, are at once characteristic of the difference between the two groups.† They also bear some kind of relationship to Sinodendron‡ amongst the Lucanidæ; indeed, Fabricius placed some of the species in that genus. They, moreover, seem to be allied to Anobium, not only in their wood-boring habits, but also in the position of the head, and the large size of the terminal joints of the antennæ. This affinity is, moreover, supported by the structure of the larva of

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* BIBLOGR. REFER. TO THE BOSTRICHIDÆ.

Guérin. Icon. R. An. Insectes.
Perty. Delect. An. Art. Bras.
Westwood, in Guérin Mag. Zool. (Dysides).
The general works of *Fabricius, Gyllenhall, Stephens, Kirby, &c.*

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† I have published some observations upon this point in the first number of the Transactions of the Entomological Society.

‡ Mr. Kirby notices, in support of this relation, that lamellated antennæ are found in Phloiotribus and Sinodendron; that the spurious joint between the claws of the tarsi and spinose tibiæ, are found in Bostrichus; and that the head of some of the species of the last named group is cornuted.

Bostrichus, as described by Latreille (*Hist. Nat.*, &c. vol. xi. p. 222.), which is short, soft, 12-jointed, and generally curved; with six scaly legs and a scaly head; armed with strong jaws, enabling the larvæ to gnaw the wood upon which they subsist, and in which they undergo their transformations. More recently, Dr. Erichson has observed that this family appears to be intermediate between Clerus and Anobium, mentioning the discovery by Professor Ratzeburg of the larva of Apate (Bostrichus), "welche in Gegensatz der fusslosen Bostrichen (Scolytus) Larven viel Uebereinstimmung mit denen der Anobien zeigen." (*Weigm. Arch.* 2. p. 46.) Dr. Ratzeburg has himself since published a figure of this larva in his *Forst-Insecten. Coleopt.* tab. xiv., from which my *fig.* 31. 10. is a copy.

It is not possible to determine with precision the insect to which the name Bostrichus was given by the ancients. Mr. MacLeay considers that it was, probably, some male glowworm. The genus Bostrichus was established by Geoffroy for the reception of the Dermestes capucinus *Linn.* Fabricius, long subsequently, gave the generic name of Apate to the same insect, which ought consequently to be expunged. With equal impropriety, Fabricius gave the name of Bostrichus to the Scolytus destructor. The Fabrician nomenclature is still retained in Germany as regards the former of these genera.

Some of the exotic species are upwards of an inch in length, and, consequently, the damage which they produce to timber must be very considerable. The British species are few in number, of small size, and considerable rarity; indeed, it is not improbable that some of them are not really indigenous, but have been imported in timber, &c., from abroad, as in the instance of Dinoderus ocellaris, described by Mr. Stephens, from my collection, which I found floating in a cup of coffee. Considerable confusion has taken place in the nomenclature of some of the species,

The European genus *Psoa*, although closely allied to Bostrichus, recedes from the general appearance of the family, in the metallic colouring of the thorax, &c., assuming, as Mr. Curtis suggests, the habit of the Cleridæ; indeed, this author considers that the connexion between these two families is established by means of it.

The genus *Phloiotribus* also appears to be referrible to this family; its antennæ being terminated by a club, composed of three very long lamellæ, resembling those of the Lamellicorn beetles; the third tarsal joint is, however, bilobed. The type of the genus, P. oleæ, has been

the subject of interesting memoirs by M. Bertrand (*Mém. d'Hist. Nat.* vol. ii.), in which its ravages upon the olive trees of the south of France are described; and by M. Tripaldi, in the *Atti del Real Instit. di Napoli*, vol. iii. p. 139.

The G. Cis (*fig.* 31. 11. Cis boleti) is also placed in the family Ptinidæ by Mr. Stephens; but from its characters as detailed in the synopsis, it will be seen that it materially differs from the typical Bostrichidæ as well as from Anobium, with which the species are often confounded (*fig.* 31. 12. represents the labrum, 13. mandible, 14. maxilla; 15. antenna; and 16. tarsus of Cis boleti). The species are of small size, and are found in fungi and boleti, growing upon the trunks of trees, upon which the larvæ subsist. I have reared Cis boleti from the larvæ, which nearly resemble those of the Ptinidæ, and are of a fleshy white colour, and of a cylindric but curved form, (*fig.* 31. 17. larva of Cis boleti); the head is scaly, as well as the mandibles and six legs, but the antennæ are distinct (*fig.* 31. 18. front of the head); the extremity of the body is armed on the upper side with two recurved hooks, the terminal segment not being larger than the preceding (*fig.* 31. 19.). I have often found these insects in all their states in the same fungus. The tail of the pupa is also armed with a pair of minute spines * (*fig.* 31. 20.).

The tenth family, SCYDMÆNIDÆ †, is of small extent, and the insects of which it is composed are of a very minute size (*fig.* 31. 21.

* M. Bouché (*Naturgesch. der Ins.* vol. i.) has published a description and figures of the larva and pupa of the same species; but the latter scarcely convey a correct idea of the insect in these states, being too much elongated, having probably been drawn from specimens preserved in spirits, whereby the natural proportions of the body are lost.

† BIBLIOGR. REFER. TO THE SCYDMÆNIDÆ.

Kunze. Monograph in the Acta Soc. Nat. Scrut. Lipsiensis, tom. i. 1822.
Motchoulzky, in Bulletin Soc. Hist. Nat. Moscow, 1837.
Denny. Monographia Pselaphorum and Scydmænorum.
Laporte, in Ann. Soc. Ent. France, vol. i. —Ditto, Etudes Entomol.
Erichson. Kafer Mark. Brandenb.
And the general works of Stephens, Gyllenhal, Sahlberg.

Scydmænus scutellaris). The head is rather narrowed behind; the antennæ are as long as the head and thorax, and thickened at the tips; the mandibles are bidentate (*fig.* 31. 22.), and the maxillary palpi are very long, having the third joint very large and oval, and the terminal joint minute and acute * (*fig.* 31. 23.). The thorax is subglobose, broader than the head, but narrower than the elytrya, which are large and oval, and entirely cover the abdomen. The legs are long and slender, with the thighs incrassated. The tarsi are entire and 5-jointed (*fig.* 31. 24.). Mr. Denny states that the antennæ and legs of the males are much thicker than those of the females.

The transformations of these insects are unknown. They are found upon the ground, under stones, amongst moss collected in damp situations in woods, at the root of trees, &c. They may also be occasionally captured on the wing, flying in the sunshine. M. Duros discovered the Scyd. clavatus *Gyll.* in an ant's nest near Paris, a circumstance, which, with other considerations, tends to confirm the opinion of Latreille, that these insects are allied to the Pselaphidæ. Mr. Doubleday also (*Ent. Mag.* vol. i. p. 439.) records the capture of several species of Scydmænus, in company with Pselaphidæ, under planks placed upon hotbeds, where they prey upon minute Thysanuræ, carrying Poduræ and Acari about in their jaws whilst devouring them.

The situation of this family is very doubtful, Latreille (*Règne Animal*, 2d edit.) considered them allied to the Pselaphidæ. † He, however, placed them between the Lymexylonidæ and Histeridæ, at the head of his Clavicornes. In the Genera Crust., &c. the same author placed them between the Ptinidæ and Staphylinidæ; and, in the first edition of the *Règne Animal*, they were introduced between the Lymexylonidæ and Cleridæ. Mr. Stephens makes them the connecting link between the Pselaphidæ and the Heteromerous Notoxidæ; observing, however, that "there is considerable affinity between the Scydmæni and the Engidæ; and I suspect the genus Eutheia forms the bond of union between them;" with which I am inclined to agree.

* This last joint was, indeed, overlooked by Kunze, who established a section with the character "palpis 3-articulatis." M. Laporte has also fallen into the same error (notwithstanding its correction by Mr. Denny), having formed the insects, composing Kunze's section above-mentioned, into the genus Eumicrus in the *Ann. de la Soc. Ent. de France*, vol. i. distinguished by a similar character.

† Dr. Erichson has united them with the Pselaphi in the same family.

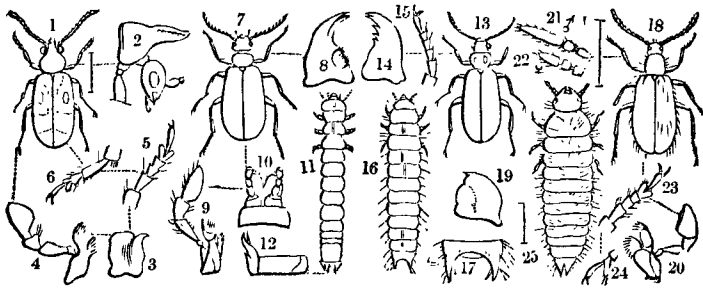
The family comprises only the three genera, Mastigus *Latr.*, Clidicus *Laporte* (from Java), and Scydmænus. The insects of the last named genus, which do not exceed one-eighth of an inch in length, have attracted the attention of several entomologists on account of their interesting structure and affinities. Mr. Stephens has described several new species in his *Illustrations* and the Appendix thereto, in which he has proposed to separate the Scyd. thoracicus *K.* (*Denny, Mon.* pl. 11. *fig.* 3.), having the thorax very broad, dilated in front, and the antennæ with the eighth joint smaller than the seventh, under the generic name of Megaladerus. It is the genus Tyttosoma of M. Wesmael.

In the genus *Mastigus* the elytra are united, and the basal joints of the antennæ are very much elongated. M. palpalis *Latr.* is a reputed British species. Dr. Waltl states that this species resides amongst grass at the foot of walls, in society, and that they are to be found lying, in heaps together like bees when swarming (*Reise nach Tyrol, &c.*, Passau, 1835.) Dr. Klug has published a monograph upon this curious genus, in his *Entomologische Monographien* in which he has described six species, one of which is figured in Guérin's *Icon. R. An. Ins.* t. xvii.., and Dr. Waltl has added another species in the work above quoted. I have observed two curious minute insects embedded in gum animé; which, from the large size of the palpi to appear to belong, this family, forming two new genera. In one of these the antennæ are terminated by a 3-jointed clava, having the fifth joint considerably elongated, and in the other these organs are short and perfoliated.

Sect. ii. HETEROMERA.

THE second general section of the Coleoptera, or the HETEROMERA of Latreille, comprises those beetles in which the four anterior tarsi are 5-jointed (*fig.* 32. 5.); the posterior pair only 4-jointed (*fig.* 32. 6.); a character, which, notwithstanding the recent observations of various French entomologists as to the artificial nature of the group which exhibits it, appears to me to be of sufficient importance for retaining the division, at least until we are more perfectly acquainted with the preparatory states of the various subdivisions of which it is composed. Hence it is that I have not thought it proper to retain Mr. MacLeay's name of Thysanuromorpha, the transformations of

Fig. 32.



the genus Meloe, which is the only example of this stirps cited by that author, being still involved in so much obscurity.

The majority of these insects feed upon vegetable matter; many are found in flowers, and these are generally gaily coloured; others, however, frequent dark and damp places, and their colours are uniformly black; whilst some inhabit the sandy deserts of tropical regions, and their colours are generally grey or dirty brown.

This division comprises several extensive groups, whose investigation has been but little attended to; and whose classification, especially with reference to their affinities with other tribes, is attended with great difficulty. Some of the species, composing the subdivision Trachelia, seem in their habits and general appearance to resemble the Telephori, Dasytes, &c.; indeed, Lamarck, by placing these groups in juxta position, evidently considered this relationship as an important one. The Tenebrionidæ apparently exhibit an affinity with the Trogositidæ; indeed Trogosita Calcar, *Fab.* is the type of Dejean's Heteromerous genus Calcar nearly allied to Tenebrio; whilst Hypophlæus, and some other subcortical Heteromera, equally approach some of the Necrophagous genera, such as Cerylon, &c. The larvæ of the Tenebrionidæ or meal worms, and the Helopidæ and Cistelidæ, seem, however, in their cylindrical and corneous structure, and occasionally denticulated extremity of the body, to approach most nearly to those of the Elateridæ, (although the larvæ of the latter family differ very materially in the structure of the mouth, from those of the Helopidæ, &c.); whilst the Œdemeridæ seem equally allied to certain Pseudotetramera, such as Necydalis and Leptura, and the Mycteridæ or Salpingidæ to the Rhyncophora; indeed Latreille does not hesitate to place Salpingus amongst the

latter insects. Mr. Stephens has adopted two apparent relationships of this division, neither of which appears to me to have any real existence: in the first place, he unites the Heteromera with the Pseudotrimera by means of Hispa (which is a real Pseudotetramerous insect) and Sarrotrium; and, in the second place, he introduces the Pentamerous Scydmænidæ into this section, and makes them the connecting link between the Notoxidæ and the Pselaphidæ, with neither of which groups, as it appears to me, does it possess any real affinity. That the affinity of Endomychus and Lycoperdina (notwithstanding the coccinelliform larva of the former) is towards some of the Taxicornes of Latreille, such as Diaperis and Boletophagus, is a question which requires considerable investigation.

According to M. L. Dufour, the male organs of generation have a texture approaching those of the Scarabæi and Silphæ, whilst the internal anatomy of the Tenebrionidæ, Blapsidæ, &c., considerably resembles that of the Pentamerous Carabidæ; whilst, as further instances of the latter relationship, it may be noticed that, with Linnæus, Cychrus rostratus was a Tenebrio, Aristus bucephalus was with Fabricius a Scaurus, and the Helopideous genus Adelium *K.*, was arranged by him with Calosoma.

Latreille divided the present section into four groups or families (as he termed them) arranged as follows: —

1. Elytra hard; tarsal claws simple; head not narrowed behind into a neck.
   1. *Melasoma.* — Apterous; antennæ moniliform; maxillæ with an internal tooth. Typical genera Pimelia, Blaps, Tenebrio.
   2. *Taxicornes.* — Winged; antennæ perfoliated; maxillæ unarmed. Typical genera Diaperis and Cossyphus.
   3. *Stenelytra.* — Winged; antennæ simple; maxillæ unarmed. Typical genera Helops, Cistela, Melandrya, Œdemera, Mycterus.
2. *Trachelides.* — Body soft; tarsal claws often bifid; head narrowed into a neck. Typical genera Lagria, Pyrochroa, Mordella, Anthicus, Horia, and Meloe.

The more recent and elaborate researches of Guérin, Solier, and Curtis in this section, have shown that the dentated internal lobe of the maxillæ is not a character constant nor exclusive in the first group. Thus, in Erodius and Scaurus, the tooth is wanting; whilst, in the Helopideous genus Acanthopus, the tooth is strong, and even bifid; the genera Stenochia, Phaleria, and Uloma, also possess this tooth; hence, as well as from other considerations, M. Solier has recently proposed another distribution of the section in the *Annales*

de la Soc. Entomol. de France for 1834, of which the following is an abstract: —

1. *Scleropterides* — Tarsal claws simple; anterior coxæ orbicular, not extending beyond the prosternum.
   A. *Phrenapatides.* — Two anomolous genera, Phrenapates and Trictenotoma.
   B. Mandibles short, scarcely protruded, simply bi- or tridentate.
      * *Collapterides.* — Elytra united; wings wanting. Typ. gen. Erodius, Pimelia, Blaps, Pedinus.
      ** *Corysopterides.* —Elytra free; wings 2. Typ. gen. Tenebrio, Helops, Diaperis.
2. *Xystropides.* — Tarsal claws denticulated; neck wanting. Typ. gen. Cistela.
3. *Euschionides.* — Tarsal claws simple or bifid; neck generally distinct; anterior coxæ long and produced.
   * *Clynocephalides.* — Head not narrowed into a neck nor rostrated. Typ. gen. Serropalpus, Melandrya, Ripiphorus, Mordella.
   ** *Trachelides.* — Head generally narrowed into a neck, &c. Typ. gen. Horia, Meloe, Pyrochroa.
   *** *Leptoderites.* — Head not formed into a neck, often rostrated; thorax narrow. Typ. gen. Lagria, Salpingus.

We thus see the first three Latreillian groups are condensed together, whilst portions of the third and the fourth are much dilated in their distribution. Moreover, that a trifling character like the denticulation of the tarsal claws should be considered sufficient to raise the species of Cistela possessing it to a primary division (notwithstanding their affinity with Helops is so strong, that these two genera are by several entomologists placed in the same family), does not impart much authority to this mode of distribution; whilst the series of names, formed at complete variance with the ordinary series of sectional names, will not greatly assist in facilitating the study of this difficult group. Nevertheless, the juxta position of several of the divisions appears more natural than that of Latreille, who was, indeed, aware of the intimate relationship of Helops with Tenebrio, with which, indeed, it was united by Linnæus; and of the connection existing between the Melasoma and some of the Taxicornes, such as Phaleria and Diaperis; indeed, the transition from Tenebrio to Helops, by means of Phaleria, is exceedingly gradual. Without strictly adhering to either of the preceding modes of distribution, I have adopted the most apparent connections indicated by each, and have ventured to commence the distribution with Latreille's Trachelides, as being apparently most nearly allied to the Malacoderma * as indicated by Lamarck. Latreille, on the other hand

* This may be supposed to be effected, either by Telephorus and the Lyttæ, or by Scydmænus and the Notoxidæ.

by placing the Melasoma at the head of the section, had evidently in view their supposed relationship, with the Lamellicornes, which cannot here be adopted in linear classification, the Lamellicornes being placed at the head of the stirps of Chilognathiform Pentamera. A similar difficulty, also, here exists; because, by considering the Stenelytra as following the Trachelides, and as being succeeded by the Taxicornes and Melasoma (which would thus be placed at the end of the section), we are unable to make the Salpingidæ (amongst the Stenelytra) the means of uniting the Heteromera and Pseudotetramera, the latter having the Curculionidæ at its head, with which, indeed, the Melasoma have no affinity. This kind of difficulty is the necessary result of endeavouring to exhibit, in a linear series the intricate affinities of this extensive order of insects.

The typical genera, mentioned above, seem to be equivalent with the rank of the Linnæan genera, and are, consequently, to be regarded as modern families terminating uniformly in idæ.

By uniting the Xystropides of Solier (Cistelidæ) with the Scleropterides, the Heteromera are divisible into two primary groups, nearly corresponding with Latreille's two primary sections indicated above, although some of Latreille's secondary group, Stenelytra, are evidently more intimately allied to the second primary group than to the first. These two primary groups are very difficult to characterise, and the following definitions must be regarded only as approximating to precision. As they do not precisely correspond, either with the divisions of Latreille or Solier, I have thought it necessary to substitute other denominations.

In the first of these tribes, which may be named TRACHELIA, (nearly corresponding with Latreille's Trachelides and Solier's Euschionides), the head is generally considerably dilated behind the eyes, and then suddenly narrowed, the prothoracic cavity not equalling in breadth the broader part of the head, which is thence exposed. The insects are generally of gay colours, flying and running with agility by day, and hence the fore-legs are organised for quick motion by having the coxæ elongated.

In the second of these tribes, which I name ATRACHELIA, (nearly corresponding with Latreille's first primary division, and with Solier's Scleropterides and Xystropides, the prothoracic cavity is as wide as the broad part of the head, the hinder part of which is consequently immersed up to the eyes; the insects are often of dull and obscure colours, seldom appearing by day (except in those species

which evidently form the connecting links between the two divisions), and being slow in their movements, with the coxæ of the fore-legs shortly rounded. *

The TRACHELIA are further distinguished by having the body generally of a soft consistence, with the elytra flexible, sometimes very short, and folded on the inner margin over each other; in others, not uniting in a straight suture. The maxillæ are not unguiculated. The penultimate tarsal joint is often bilobed, a peculiarity often dependent upon the arborial or floral habits of the species; the posterior coxæ are approximated together, and the tarsal claws are often irregular, being either bifid or (more rarely, Horia, Mordella,) toothed. The antennæ are generally elongated and filiform or branched. Many of these insects, when alarmed, counterfeit death by contracting their legs and antennæ. They are chiefly found in flowers or upon trees, and are often very active. Some are parasitic in the nests of bees.

This subsection, provisionally comprises the nine following families, which I have endeavoured to arrange in accordance with their affinities; Notoxidæ, Pyrochroidæ, Lagriidæ, Horiidæ, Mordellidæ, Cantharidæ, Salpingidæ, Œdemeridæ, and Melandryidæ.

The first family, NOTOXIDÆ†, *Stephens*, is of small extent and composed of insects of minute size (*fig.* 32. 1. Notoxus monoceros, 32. 2. the front of the body seen laterally), having the head subcordate, the penultimate joint of the tarsi bilobed (*fig.* 32. 5. 6.), and the antennæ simple, filiform, or slightly thickened at the tips, either gradually, or with the three last joints evidently enlarged; the claws of the tarsi are entire, the mandibles are strong and triangular or quadrate, (*fig.* 32. 3.); the maxillary palpi are terminated by a large hatchet-

* The correspondent variation of habits, structure, and colours in these two divisions is remarkable. The diurnal versicolorous species have need of increased activity and attention, and their heads are therefore accordingly constructed, so as to afford increased powers of vision.

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† BIBLIOGR. REFER. TO THE NOTOXIDÆ.

Hope, in Trans. Zool. Soc. i.
Saunders, in Trans. Ent. Soc. i.
Guérin, in Voy. Coq. Ins. pl. 5.
Say. American Entomology, and the general works of *Ahrens*, *Panzer*, *Stephens*, *Gyllenhall*, *&c.*

shaped joint (*fig.* 32. 4.); the thorax is narrowed behind, occasionally nodose, and not so broad as the elytra; the eyes are entire or but slightly notched. The majority of these insects are found upon the ground and at the roots of grass, in sandy situations; some evidently prefer the neighbourhood of decaying vegetable matter; and some are found on flowers. They are very active in their motions, and fly with agility.

Latreille considers their larvæ to be parasites, and M. Solier has observed that Anthicus instabilis is occasionally troublesome during the evening, creeping under his clothes, and causing considerable irritation with its claws, and also, as he considered with its jaws, as he observed a small wound. Hence he imagined that this species might be carnivorous in its habits.

In the genus Notoxus, as now restricted, the front of the thorax is produced into a long horn extending over the head, which peculiarity is not confined, as in the Lamellicorn beetles, to the male sex alone. Latreille adds the genus Scraptia to this family, which seems more nearly related to the Melandryidæ; and Stephens inserts Xylophilus, &c., which I had at first regarded as belonging to this family, but which the dissections of Mr. Curtis have proved to possess a greater affinity with Nothus, &c.

The second family, PYROCHROIDÆ* *Leach*, is allied to the Lagriidæ in the form of the tarsi and narrowness of the front part of the body, which, however, is flattened, with the neck distinct, and the thorax suborbicular (*fig.* 32. 7. Pyrochroa rubens); the antennæ of the males are generally more or less pectinated or serrated; the mandibles are acutely bifid at the tips (*fig.* 32. 8.); the maxillary palpi are also somewhat serrated, with the last joint subsecuriform (*fig.* 32. 9.); and the labial palpi filiform and 3-jointed, (*fig.* 32. 10.); the abdomen is moderately long, and covered by the elytra, much broader than the thorax, and rounded at the tip.

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* BIBLIOGR. REFERENCES TO THE PYROCHROIDÆ.

Fischer. Act. Soc. Nat. Mosc. vol. iii. and Ent. Russ.-Pogonocerus (Dendroides.)
Guérin. Ann. Soc. Ent. Fr. No. 6. (Pseudolycus.)
Newman. Ent. Mag. No. 24.

These insects are found in the spring and early summer months; they are generally gaily coloured and active in their flight, although they walk but awkwardly; they frequent leaves and flowers, but the larvæ are found under the bark of trees and in rotten wood. I obtained the larvæ of P. rubens, from a rotten willow in Horningsea Fen, during the trip of the British Association at the meeting held at Cambridge. I have also found the pupa of the same insect in rotten willows at Battersea, in the middle of April, and which, in a week, assumed the imago state; the pupa was of a dirty white colour, and the rudimental wings and wing-covers were short, so that I at first thought it was the pupa of one of the Staphylinidæ; the larva (*fig.* 32. 11.) is long, linear, and depressed, especially the head and thoracic segments, which are more scaly than the following joints; the antennæ are shorter than the head, and 4-jointed; the segments of the body are transverse, rounded at the sides, with deep incisions at the articulations; the 11th segment is very short; the 12th large, square, and more horny than the preceding; as is also the 13th or terminal segment, which is broader than the preceding, and armed with two sharp spines directed upwards (*fig.* 32. 12.). This segment is furnished on the underside with an anal pro-leg; the six thoracic legs are rather short, very thick, and inserted at the sides of the segments; the colour of this larva is dirty ochre, with the head and tail somewhat darker. Ahrens has described and figured (in an indifferent manner) the larva and pupa of Pyr. coccinea in the 6th number of *Silbermann's Revue Entomologique* (p. 14.); they are found under the bark of birch, and in the trunks of decaying oaks. He is inclined to believe that the larvæ are three years in arriving at their full size; the pupa state continues fourteen days.

The family is of difficult location, as may be observed from the numerous situations in which it has been placed at various times by Latreille. With Calopus and Scraptia it certainly appears to have a near relation, but with Ripiphorus and Mordella, a very slight one. Mr. Curtis remarks that the trophi of Pyrochroa are most like those of Sitaris; but nothing can be more distinct than the habits and economy of these two groups. In the latter respect, as well as in the general habits, Pyrochroa makes a much nearer approach to Pytho (*fig.* 32. 13. Pytho depressus), which is placed by Latreille amongst the Helopidæ, and by Solier between Lagria and Salpingus; but which, from the preceding considerations, I would introduce into the present

family, notwithstanding its simple penultimate tarsal joint * (*fig.* 32. 15.) : one of its mandibles is represented at *fig.* 32. 14. De Geer has given an account of the larva of the Pytho depressus (an inhabitant of Europe), and which he found under the bark of fir and pines in Sweden. (*Mémoires*, vol. v. pl. 2. f. 15—20). I am indebted for specimens of this larva (*fig.* 32. 16.) to Mr. Shuckard, and which were collected in Sweden, by F. Walker, Esq., in 1836. This larva bears considerable resemblance to that of Pyrochroa, being quite flat and parallel, with the head semicircular, and narrower than the prothorax ; the 11th and 12th segments of equal size, and the 13th nearly as large, and terminated by two lateral curved denticulated spines (*fig.* 32. 17.), beneath which is placed an anal proleg. Bouché has also figured the larva and pupa of this insect, with details (*Naturg. der Ins. Tab.* ix. f. 13—22.).

The only British genus is Pyrochroa, comprising two British species of moderate size, distinguished by their pure red colours. The beautiful exotic genus, Dendroides *Latr.*, is distinguished by the elegant plumose antennæ of the males. I am indebted to Mr. R. H. Lewis for a fine species of this interesting genus, which is extremely rare in North America, where he found it in May, 1834, beneath the bark of the maple trees, of which the corduroy or crossways of the Great Huron road are formed, in company with Brentus maxillosus.

The third family, LAGRIIDÆ†, corresponding with the tribe Lagriariæ of Latreille, is characterised by having the head and thorax considerably narrower than the elytra, which are soft and flexible, (*fig.* 32. 18. Lagria hirta, ♂.). The thorax is subcylindric or ovoid and

* Mr. Kirby has introduced this interesting genus into the family Cucujidæ, asserting its affinity to my genus Catogenus. I cannot, however, adopt this relation as of so high a value as that which is manifested towards the Pyrochroidæ.

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† BIBLIOGR. REFERENCES TO THE LAGRIIDÆ.

Guérin. Icon. R. An. Ins. p. 34.

Newman. Ent. Mag. No. 24.

St. Fargeau and Serville, in Enc. Méth. art. Statira ; and the general works of *Fabricius, Olivier, Herbst*, &c.

truncate; the eyes are emarginate, with the antennæ inserted within the notch, and filiform, or but slightly thickened towards the tips, and with the last joint longer than the preceding, especially in the males (*fig.* 32. 21. extremity of ♂ antennæ; 32. 22. ditto ♀ antennæ). The palpi are thickened at the tip, the terminal joint of the maxillary being reversed-triangular (*fig.* 32. 20.). The mandibles (*fig.* 32. 19.) are short and thick. The femora are oval and clavate; the tibiæ long and slender, those of the anterior leg sometimes curved; the penultimate joint of the tarsi is bilobed, and the claws simple (*fig.* 32. 23. anterior tarsus; 24. ditto, seen sideways).

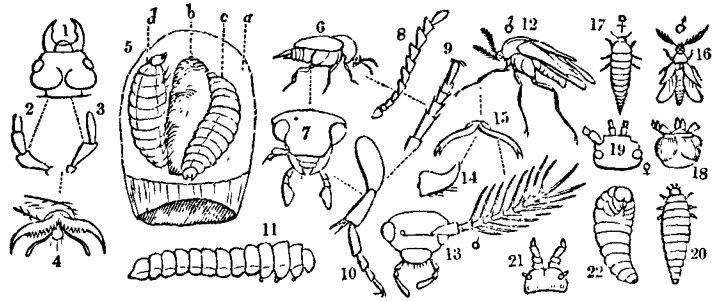
These insects are found in woods and hedges, and upon various plants, counterfeiting death when alarmed, like the Cantharidæ. Their bodies are soft, and their motions on the wing active, although they creep but awkwardly. The species are few in number, although widely dispersed, being found in almost every region: one only inhabits our own country, as mentioned in my synopsis.

I have often beaten its larva (*fig.* 32. 25.) out of whitethorn hedges in October; and Mr. Ingpen has reared it to the perfect state. It is of a rather thickened and somewhat cylindric form, and leathery texture, densely clothed with brown hairs, having the head deflexed, with the antennæ distinct, and laterally porrected; the legs are short, and the three terminal segments are gradually attenuated, the last terminating in a bifid point: I have also found these larvæ in April; and have observed, that, in the beginning of the following month, they have shed their skins, and increased considerably in size, so that I should suppose these individuals would not arrive at the perfect state until the following spring.

Lyonnet has also given a description and figures of the preparatory states of this insect, published in his *Recherches*, pl. 11. The larvæ were found in the winter, at the roots of trees, under dead oak leaves, upon which Lyonnet states that they fed. When disturbed, they rolled themselves up, with the head bent towards the tail; on the 3d July, the larva assumed the pupa state, without forming any cocoon. The pupa is hairy, and is also furnished at the sides of the abdomen with eight pairs of large tubercles, which are hairy. The imago appeared in the same summer.

The fourth family, HORIIDÆ*, is distinguished by having the tarsal claws denticulated, and furnished on the underside with a long and slender filament (*fig.* 33. 4.). The head is large and considerably

Fig. 33.



dilated behind the eyes (*fig.* 33. 1. head of Horia maculata); the jaws large, porrected, and terminated by an acute point; the antennæ rather short; the upper lip small; the palpi filiform; the labial (*fig.* 33. 3.) as long as the maxillary (*fig.* 33. 2.); the thorax subquadrate; the elytra flexible; the tarsal joints entire; and the hind legs robust, especially in the males.

This family is of a very small extent; the species are of a comparatively large size, and handsomely coloured. They are confined to tropical countries. The Rev. Lansdown Guilding has described the transformations of Horia maculata, an inhabitant of South America and the West Indies (*Trans. Linn. Soc. Lond.* v. 14. p. 316. pl. 8. and v. 15. p. 511.). Its larva (*fig.* 33. 5. *d.*) destroys that (*fig.* 33. 5. *c.*) of a species of wild carpenter bee (Xylocopa teredo, X. morio *Fab.*), which makes its cells (*fig.* 33. 5. *a.*) and deposits its eggs in the trunks of trees. Mr. G. conjectures that the larva of the beetle feeds upon the provisions (*fig.* 33. 5. *b.*) destined for the food of the larva of the Xylocopa, and which is consequently starved to

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* BIBLIOG. REFER. TO THE HORIIDÆ.

Guérin. Icon. R. An.
Griffith. Animal K. Ins.
Sturm. Insect. Catal. Tab. 3. fig. 25.
Guilding. Linn. Trans. v. 14. and 15.
Hubner, in der Naturforscher, St. 24.
Swederus, in Act. Holm. 1787. (Cucujus (Horia) maculata.)

death. He thus describes the larva: "Hexapus, pallide ochracea, nuda, nitida, ore nigricante;" adding (vol. xv. p. 511.), "Corpus spinulis omnino indistinctis exasperatum; tracheæ fuscæ; mandibulæ ferrugineæ;" pupa "nitida, oblonga, flavescens, linea dorsali ochracea, oculis, mandibulis, membrisque saturatioribus." The habits of the parasite are thus doubtingly described:—"Nidis Xylocopæ Teredinis nutritur. Forsan dum larva cibum apibus preparatum avidè consumit, hospes fame perit. Mox matura proprium nidum excavat? introitum claudit ac metamorphosin subit." W. Sells, Esq. of Kingston, possesses Mr. Guilding's specimen of this larva, which is transfixed with a pin and dried; so that it is now much more slender than represented above: it is also much more curved (like a Lamellicorn larva), with deeply constricted segments; the six legs very short, and the extremity of the body entire.

M. Westermann (in his letter to M. Wiedemann, published in *Silbermann's Rev. Ent.* No. 3.) has stated that in Java, Horia maxillosa and testacea (G. Cissites *Latr.*) are found in houses, where they do much damage to the wood work, by forming deep furrows, serving as a retreat for their larvæ; but, from the statements of Guilding given above, it is evident that the Horiæ were parasites, and that the injuries were caused by some other insects upon which the Horiæ feed.

The fifth family, MORDELLIDÆ* *Leach*, is distinguished by the general form of the body, which is elevated and arched, with the head inserted very low (*fig.* 33. 6. Mordella fasciata slightly mag-

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* BIBLIOG. REFER. TO THE MORDELLIDÆ.

Fischer. Ent. Russ. vol. ii. — Ditto, in Bull. Soc. Nat. Hist. Mosquens. 1829. vol. i. t. 6. and Trans. Soc. Mosc. vol. ii.
Guérin. Icon. R. An. pl. 34.
Perty. Delect. Anim. art. Bras. t. 13.
Laporte. Institut. 1833. p. 173. (G. Pelecotoides.)
Guérin and Percheron. Genera des Ins. t. 2. (G. Evaniocera.)
Dalman. Swed. Trans. 1825. pl. v. (Ripidius.)
Giorna, in Mem. Acad. Scienc. Turin, tom. i. An. x. and xi. p. 216. (Mordella ambigua, Ripiphorus subdipterus.)
Sundeval, in Isis. 1831. (Symbius.)
Royle's Himalaya. Ins. pl. i.
Thunberg. Swed. Trans. 1806.
Hentz, in Trans. Amer. Phil. Soc. v. iii. (G. Macrosiagona.)
Rosc. Journ. d'Hist. Nat. v. ii. (Ripiphorus subdipterus.)

nified). The thorax is trapezoid or semicircular; the elytra either very short, or acuminated at the extremity as well as the abdomen; the head (*fig.* 33. 7.) is trigonate-ovate, very much inflexed, and closely applied to the prosternum; the penultimate joint of the tarsi is simple, but the claws are bifid; the superior division being pectinated in some of the large exotic species of Mordella (*fig.* 33. 9.), Ctenopus *Fisch., &c.* The antennæ are rather short (*fig.* 33. 8.), and often pectinated or flabellate (*fig.* 33. 13.). In the typical genera, the hind legs are broad and compressed, with long tibial spurs (*fig.* 33. 10.), evidently serving for their quick motions.

From the structure of their antennæ, some of these insects approach the Pyrochroæ; whilst others, in their maxillæ, tarsal claws, and parasitic habits, are more allied to Nemognatha and Sitaris in the following families. They are, however, distinguished from all these insects by their great agility, and by the firmer consistence of their bodies. From a calculation given by Müller, it would appear that the eyes of a species of Mordella are furnished with 25,088 hexagonal facets. Mr. Hentz has noticed another interesting peculiarity in a North American species of Ripiphorus (R. dimidiatus, forming the type of the subgenus Macrosiagona *Hentz.*), in which the maxillæ are terminated by a long, slender, and pilose filament, capable of great extension, and analogous to the maxillary setæ of Gnathium in the following family (*Trans. Amer. Phil. Soc.* vol. 3.).

These insects are of various habits. The smaller typical species frequent flowers, especially those of the whitethorn and umbelliferæ. These are extremely active, fly with rapidity, and leap well; the posterior coxæ very greatly developed, equalling in size the entire metasternum, and evidently enlarged for supporting the muscles necessary for the increased activity of these insects. When alarmed they draw the head close against the mesosternum. The larva of Mordella pusilla is described and figured by Schilling (in the *Beitrage zur Entomol.* 1829): it is long, subcylindric, with the articulations deeply incised (*fig.* 33. 11.); six short pectoral or thoracic legs, and with the terminal segment smaller than the preceding, and obtusely pointed. The sides of the segments appear to be furnished with fleshy tubercles. It was found abundantly in the stems of Artemisia vulgaris in September and October, feeding upon the pith: in the beginning of the following spring they assumed the pupa state, and were transformed to beetles, in about thirty days. Mr. G. R. Water-

house reared a species from some rotten wood placed in his breeding cages, without, however, having noticed its larva.

M. Vallot (*Acad. Scienc., Arts et Belles Lett., Dijon*, 1829, p. 30.) has also published a notice of the larva of Mordella pusilla *Dej.* found in the stems of Marrubium vulgare (common horehound). He describes it as footless, yellowish, covered with short, black hairs; the segments, 12 in number, very distinct, the terminal one furnished with a short, double, black spine. The head is of the colour of the rest of the body, and the mandibles brown. It is found in the winter feeding upon the medullary substance of the stems. It is transformed into a pupa in June, and the imago appears in July.

The Persian genus Ctenopus *Fischer*, which Latreille regards as connecting Mordella and Pelecotoma, appears to me much nearer allied to Sitaris, to which Ripiphorus also nearly approaches.

The species of the genus Ripiphorus, on the contrary, are parasitic upon other insects. The typical species R. paradoxus (*fig.* 33. 12. ♂) was first recorded by Germar (*Mag. der Ent.* v. i.), as inhabiting in the perfect state the nests of the common wasp (where it has been taken abundantly by the Rev. F. W. Hope, to whom I am indebted for specimens in different stages of maturity); whence Latreille observes, that it has been inferred that it subsists in that situation in the larva state, and is probably nourished by the wasps as their own offspring. On arriving at the perfect state, it emerges from the nest, and seeks the flowers; and it is probable that the female deposits her eggs in the already formed cells of the wasps, her abdomen being well adapted for such purposes, being long and acuminated.

J. W. Bond has also published a notice of the parasitic habits of this insect in the *Entomological Magazine*, No. 18. p. 225.; and the Rev. F. W. Hope (*Zool. Journ.* v. iii. p. 606.) has mentioned that "the larger specimens of the Ripiphorus paradoxus, which are much more rare than the smaller ones, are uniformly found only in the cells of the female wasps." The latter author has also communicated some further observations upon the same insects and its parasites to the Rev. W. Kirby, by whom they have been introduced into his *Bridgewater Treatise*. Mr. Howitt in his *Book of the Seasons*, and Ramdohr (*Germar, Magaz. der Entomol.* i. 137.), have given some original observations on the habits of the same insect. My *fig.* 33. 13. represents the head of the male; 14. one of the mandibles, and 15. the bifid tarsal ungues.

M. Farines (*Annal. Sc. Nat.* June 1826, p. 244.) has published a

notice of the habits of Ripiphorus bimaculatus, the larva of which, according to this author, resides in the root of the Eryngium campestre (field eryngo), which it perforates in the centre, and always in a vertical direction, thus differing entirely from that of R. paradoxus. It is not, however, impossible, that the larva may be parasitic upon some larva residing in such a situation. When full grown, it works its way out of the root at the end of June, forms a pedunculated cocoon of the size of a small nut, attached to the stem of the plant, and assumes the perfect state in July.

M. Sundeval has published a detailed account (in the *Isis* of Oken for 1831), of a small insect nearly allied to Ripiphorus, which is parasitic in the bodies of Blatta americana, on board of ships, and which he names Symbius Blattarum (*fig.* 33. 16. ♂, 17. ♀, 18. head ♂, 19. head of ♀.). The male is winged and very alert, but its elytra are very short and narrowed; its antennæ are beautifully pectinated; the female, on the contrary, is destitute of wings and elytra; the body is elongate-ovate, attenuated behind, and terminated by a long and slender ovipositor; the antennæ are short and simple. The larva (*fig.* 33. 20.) closely resembles the female, but the structure of the antennæ, &c., (*fig.* 33. 21.) is less perfect, it is entirely of a pale-brownish colour; the terminal segment of the body is small, entire, and the anus simple; the mouth is furnished with two very large 4-jointed conical porrected palpi. The pupa of the female is represented in *fig.* 33. 22. This genus appears identical with the genus Ripidius of Thunberg, of which Dalman has published an account of two species found in gum copal, in the *Swedish Trans.*, 1825, (pl. v. f. 1-8.). Mr. Stephens has also described another species, found dead amongst Admiralty papers received from Portsmouth, under the name of Ripidius? anceps (*Brit. Ent.* v. p. 427.), and which is most probably identical with the Symbius blattarum. The eyes in both insects are united on the crown, thus differing from Myodites of Latreille, by whom they are given as synonymous.

The sixth family, CANTHARIDÆ* *Leach* (or which, in order to avoid the confusion occasioned by the synonyms of the genus

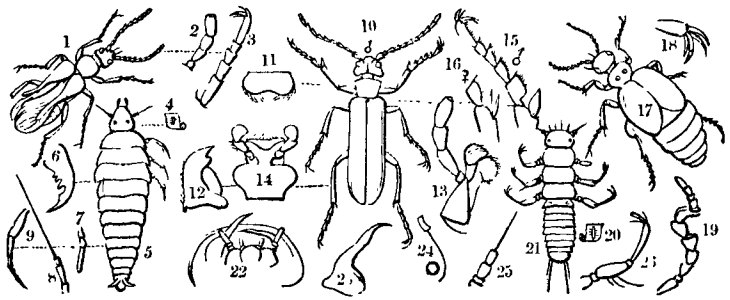
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* BIBLIOG. REFER. TO THE CANTHARIDÆ.

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Billberg. Monographia Mylabridum, Holm. 1813. 7 col. pl. (51 species.)

Fig. 34.



Cantharis, it would be more convenient to name Meloidæ), is an extensive group, having for its type the common Cantharis of the Pharmacopœia (Cantharis vesicatoria, *fig.* 34. 10.), and is distinguished by the head being dilated behind the eyes, and then suddenly narrowed into a short neck; and by the claws of the tarsi, which are bifid, or rather are respectively furnished with an additional slender and curved claw (*fig.* 34. 18.). The mandibles terminate in a simple point; the palpi are filiform, or but slightly thickened at the tips; the abdomen is soft, and the elytra flexible, and deflexed at the sides; the thorax is narrowed behind, and of a cordate, truncate, or suborbicular form. The joints of the tarsi are not dilated, nor is the penultimate joint bilobed.

Audouin. Anat. des Cantharides. Ann. des Sc. Nat. v. ix. p. 31.

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Guérin. Mag. Zool.

Audouin, in ditto, pl. 169.

Kirby. Century in Linn. Trans. vol. xii.

Zier. Sur le Développement de la Cantharide, in Brande's Archiv. des Apothek. t. xxix. p. 209. 1829.

And the general works of *Fabricius, Olivier, Say, Herbst*, &c.

These insects are much variegated in their colours; they are generally of a moderate size; they subsist upon vegetable substances, a few, however, are parasitic upon other insects in the larva state. They counterfeit death when alarmed, and many of them, at such times, emit a thick yellowish fluid from the articulations of the legs, &c., of an unpleasant scent. The organs by which this matter is secreted have not been observed. Many of these insects possess strong vesicatorial powers, and are employed in medicine, being applied externally for raising blisters, and internally as a very powerful stimulant. The latter, however, is a very hazardous mode of treatment, requiring great care. Various species are employed in different parts of the world. Our ordinary blister-fly is the Spanish Cantharis vesicatoria (which is also imported very plentifully from St. Petersburgh). C. vittata or the potato-fly, and C. atrata, are used in North America; C. ruficeps in Sumatra and Java; C. gigas and violacea in the East Indies; C. atomaria in Brazil; C. syriaca in Arabia; Meloe majalis, M. proscarabæus, and Mylabris cichorii in China and the East Indies; M. pustulata of the Cape of Good Hope is used in China; and Lydus trimaculatus in the north of Europe. (*Penny Mag.* art. Cantharis.) The ladybird has also been used; and in the United States a species of spider supplies the place of the blister-fly (Tegenaria medicinalis, *Hentz. Journ. Acad. Philadelph.*, 1821, pl 5.).

In the *Annales des Sciences Naturelles*, vol. xiii. p. 75., is published a report upon a memoir presented by M. Bretonneau to the Académie des Sciences, entitled *Notice sur les Propriétés vésicantes de quelques Insectes de la Famille des Cantharides*, in which the vesicant property is described as existing in a powerful degree in various species of Mylabris, Meloe, and Cerocoma; but Sitaris humeralis does not possess any vesicatory principle.

In the same work (July, 1829) is a notice by M. Farines on the vesicatory powers of Mylabris, Meloe, Ripiphorus, and Zonitis.

These insects composed the Linnæan genus Meloe, from which Geoffroy advantageously separated the vesicatory species, under the name of Cantharis, by which it had been always known in medicine, but which name Linnæus had improperly employed for the insects composing the modern family, above described, under the name Telephoridæ. Fabricius, willing to uphold in this respect the Linnæan nomenclature, retained Cantharis in its Linnæan signification, and

gave to the blister-fly the generic name of Lytta; Latreille cleared up the difficulty, by giving to the Linnæan Cantharides the name of Telephorus, and restoring the name of Cantharis to the blister-fly. The German entomologists, however, still adopt the Fabrician names; and the consequence is, that the Cantharis of their systems, and that of the Pharmacopœia, are totally distinct. Other genera have been subsequently separated, and which, from the anatomical researches of M. L. Dufour, and the interesting observations of Dr. Bretonneau upon the vesicatorial powers of these and other insects, Latreille considers that a natural classification of the genera may be effected by placing the genus Sitaris at one end of the series, from its not possessing this property, and yet being in other respects closely allied to Zonitis, which is nearly allied to Cantharis, and by thus continuing the series throughout, by a comparative examination of other characters, and especially those of the antennæ.

Of the genera, Sitaris appears to be most closely allied to Ripiphorus; indeed, in respect to their habits and general structure, it would perhaps be more natural to place them in the same family, in which case Ctenopus, and perhaps Horia, might accompany them. (Mr. Stephens places the genus Sitaris in the family Œdemeridæ.) It is at once distinguished by its narrow and attenuated elytra, and by the distended abdomen of the females (*fig.* 34. 1.; 34. 2. maxillary palpus; 34. 3. anterior tarsus). This species is found in the larva state, in the nests of certain solitary mason bees, particularly those composing the genera Osmia and Anthophora; but it is not yet recorded whether they prey upon the larvæ of these insects, or merely devour the food laid up for the support of the latter. Mr. Curtis states that the Sitaris humeralis (which is the only British species) is found by M. Foudras of Lyons in the nests of Anthophora hirsuta and A. acervorum, neither of which are inhabitants of this country. Some years ago many specimens were found at the foot of a wall in a small yard at Chelsea, by the Rev. A. Badger, at the beginning of September, creeping very sluggishly about; one was found crawling up a water-butt placed against the wall; and as the Anthophora retusa is the only species found in the neighbourhood, it is most likely that the Sitaris had been reared in the nests of this insect, which, however, makes its appearance in the winged state at the beginning of the spring. M. Audouin has also observed the habits of this insect, of which the larvæ resemble, in several respects, those of Lytta and Meloe (*Ann.*

Soc. Ent. de France, 1835. p. lxxvii.). His account of these observations has not yet been published; but he has had the kindness to communicate the result to me, and to shew me his specimens illustrating the natural history of this curious insect, as well as to furnish me with some of the larvæ, which he has obtained from eggs deposited by the female. In examining the interior of the nest of a large Anthophora, very common near Sevres, he detected one of the bee-larvæ in its cell, with the interior of the body entirely consumed, a thin pellicle only remaining; and from within this bladder-like exuvia he extracted a female Sitaris, which had evidently therein undergone its transformation: he did not, however, observe whether the pellicle of the larva, or of the pupa of the Sitaris, was contained within the pellicle of the bee-larva. He subsequently found more specimens of the Sitaris at large in the nests of this bee, and observed one of the females deposit her eggs (whilst in a state of captivity), from which were hatched the minute larvæ, of which my figure 34. 5. is a magnified representation (*fig.* 34. 4. being the natural size in a scroll); from which it will be perceived that it materially differs from the supposed larva of Meloe (*fig.* 34. 21.) in several important respects, —*fig.* 34. 6. representing one of the mandibles; 34. 7. a palpus; 34. 8. an antenna; and 34. 9. one of the legs.

M. Géné has published an account of the minute active larvæ produced from the eggs of Apalus bimaculatus, which he states agree precisely in form with the Triungulinus Andrenetarum of L. Dufour, and Pediculus melittæ of Kirby; from whence, as well as from the observations of Serville, Zier, De Geer, &c., he is induced to believe that the whole of the tribe or family Cantharidæ undergo similar metamorphoses. He was unable to trace the growth of the larvæ, and states that on quitting the egg they left the ordinary envelope behind them.

The genus Zonitis is stated by Latreille to be similar in its habits to Sitaris.

Of the vesicant genera that of Cantharis is pre-eminent, having for its type the blister-fly of the shops (Meloe vesicatorius *Linn.*) (*fig.* 34. 10.), a handsome insect of a rich sericeous green colour, and varying from half to three quarters of an inch in length. This insect, which is of rare occurrence in England, is found in great abundance in the south-western parts of Europe, where it appears about the middle of summer, frequenting the ash, privet, syringa, lilac, &c., and emitting a very powerful odour.

This insect, which is now so much used in medicine, was first imported from Spain (whence, indeed, our chief supply is obtained), and from which circumstance it has obtained the name of the Spanish Fly. They have also been found in abundance in the south of France; and even in certain seasons, in the middle of Germany, more than one hundred pounds weight having been collected in 1783 near Halle (*Hoppe, Enum. Ins. Erlang.* p. 36.). In the summer of 1837 they were found in profusion in Essex and Suffolk*, (see *Ent. Mag.* No. 22. p. 208.) In the heat of the day they descend from the trees, and are easily perceived and captured by their powerful scent. They remain in the perfect state but a few days, whence it was supposed that they migrated to other countries; but the sluggish habits of the insect are completely at variance with such an idea. Various plans are adopted in capturing, killing, and drying these insects for use, it being necessary to employ considerable precaution; the odorous particles which they emit being highly corrosive, and violent affections having resulted from incautiously handling them. See Loudon's *Gard. Mag.*, 3. p. 92.; and Griffith's *Anim. Kingd.*, 31. p. 48.

The anterior tibiæ of the males are terminated by a single strong spur; the basal joint of the tarsi of the forelegs being strongly notched, and serving, in conjunction with the moveable spur, as a claw to retain hold of the antennæ of the females during copulation. Ample details of the habits and structure of this insect are given by Linnæus in his *Dissertatio Academica., resp. Lencæo.* 1762; and by Audouin in the *Annales des Sciences Nat.* vol. ix. p. 31. My figure 34. 11. represents the labrum; 34. 12. one of the mandibles; 34. 13. one of the maxillæ; 34. 14. the labium; 34. 15. the extremity of the tibiæ, and tarsus of the foreleg of the male; and in *fig.* 34. 16. the base of the anterior tarsus of the female. Its medicinal properties are detailed in various medical works, and especially in M. Leclerc's *Essai sur les Epispastiques* (Paris, 1835, 4to.); Dr. Beck's *Elements of Medical Jurisprudence* (edited by Dunlop); in Orfila *On Poisons,* vol. ii.; in the *Memoirs* of Drs. Schott and Dana, in the *Eclectic Repository*, vol. ii.; and of Drs. Woodhouse and Chapman, in the *New York Medical Repository*, vols. ii. and iii.; whence it appears that the peculiar principle of the insect is termed Cantharidin, and which, according to the analysis of Robiquet, is a white substance in small crystalline plates, insoluble in water, but

* Likewise near Southampton, by Dr. Hairby of Hundleby, who has kindly favoured me with some particulars concerning the insect, which I have communicated to the Entomological Society.

soluble in boiling alcohol. Its larvæ are stated by Latreille to reside under ground, and to feed upon the roots of vegetables, and are produced from a mass of agglutinated eggs. They have the body soft, and of a yellowish white, composed of thirteen segments, with two short filiform antennæ, and six short scaly feet. Professor Loschge has published an account of the eggs and young larvæ in the *Naturforscher* (Stuck 23.), which latter appear to be identical in form with the insect, subsequently described as the supposed larvæ of Meloe.

M. Zier has also described the larvæ produced from the eggs of Cantharis vesicatoria, as exactly agreeing with those of Meloe (*Bullet. Sc. Nat.* Jan. 1830); he, however, states that the egg is transformed into a larva without the slightest trace of the outer envelope being visible. Dr. Ratzeburg has still more recently published a figure of this insect, as the larva of Cantharis vesicatoria, in his *Die Forst. Insecten.*, vol. i. t. 2. f. 27. B.

The other species of this genus are very numerous, and are found in China, India, America, &c., possessing similar powers to those of the officinal species. In North America, the Cantharis vittata *Fab.*, which is found abundantly on potatoes, and is called the potato fly, is employed instead of the Spanish species.

A species of Mylabris, confounded with the Chinese M. cichorii *Linn.**, is also employed in the southern countries of Europe, as being equally efficacious with the C. vesicatoria; and the Chinese make use of the M. cichorii and another species, M. pustulata *Oliv.* (Sidæ *Fabr.* var.), for the like purposes, which is exported to Rio, and is the only vesicant used in Brazil. Indeed it is evident, from the account of Dioscorides and Pliny, that the first of these species of Mylabris was the ordinary vesicatory beetle of the ancients.

The genus Meloe is now confined to those apterous species, which have the body large and distended, with the elytra short, oval, and lapping over each other, at the base of the suture (*fig.* 34. 17. Meloe autumnalis; 34. 18. ungues; and 34. 19. antenna of Meloe proscarabæus ♂). These insects crawl slowly along upon the ground, or amongst low herbage, upon which they feed, especially relishing the wild buttercups (Ranunculus bulbosus and R. acris). Mr. Jeffreys also found them very abundant on Arum maculatum, near Cromlym Burrows.

* See an excellent article upon the species of this genus, by M. Guérin, in the *Dictionn. Pittoresque d'Hist. Nat.* No. 389. vol. v. p. 550.

(*Dillwyn*, p. 62.) When alarmed, they emit from the joints of the legs an oily yellowish liquor, whence they have obtained the name of oil beetles. In some parts of Spain, they are used instead of the blister-fly, or are mixed with it. They are also said by Latreille to be employed by farriers; and Hoppe tells us that they were, when he wrote (1795) in use as a specific against hydrophobia in Germany; and the oil which is expressed from these insects is used in Sweden with the greatest success, in the cure of rheumatism, by bathing the affected part. (*Drury's Insects.*) General Hardwick has also described a species of Meloe, found in all parts of Bengal, Bahar, and Oude, possessing all the properties of the Spanish blistering fly. (*Asiatic Research.* vol. v. ed. Oct. p. 213. 423.) From the medicinal properties of these insects, Latreille has surmised in his ingenious memoirs upon the Buprestis of the ancients (*Mém. du Mus. d' Hist. Nat.* vol. xii.), that that noxious animal must have been a Meloe. M. Blot, however, contends, on the contrary, that the Meloe is not serviceable in medicine. (*Mem. Soc. Linn. Calvados.*, vol. i. p. 32.)

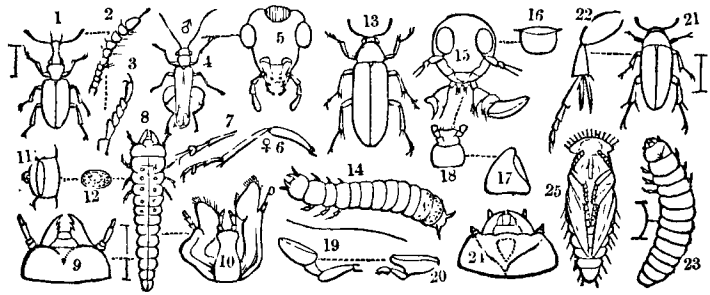
The preparatory states of these insects have been the subject of much controversy. According to Gœdart (pl. 120. *a.*), Linnæus, Frisch (vol. 1. pt. 6. t. 6.), and De Geer (vol. 5. pl. 1.), the females burrow into the earth, and there deposit a large mass of yellow eggs, agglutinated together, which produce minute larvæ of a long narrowed flattened form (*fig.* 34. 20. nat. size in a scroll; 34. 21. ditto, magnified), with 13-jointed bodies, six short legs, and two long anal setæ (*fig.* 34. 22. represents the under side of the head; 34. 23. one of the mandibles; 34. 24. the side of the head from above; 34. 25. one of the antennæ; and 34. 26. one of the legs of these minute creatures). They are exceedingly active in their movements, attaching themselves to flies, bees, &c., which it is said that they suck. This statement has been confirmed by Doubleday (*Ent. Mag.* ii. 453.), Saint Fargeau and Serville (*Encycl.* vol. 10.), Erichson and Brandt, and more recently by the Rev. L. Jenyns, who has kindly supplied me with specimens in spirits, actually reared by himself from the eggs of the Meloe. Mr. Kirby, on the other hand, regarded them as apterous parasites, naming them Pediculus Melittæ (*Monogr. Ap. Angl.* vol. 2. p. 168. pl. 14. f. 10-12.); and Dufour has even formed them into a distinct genus of parasitic Aptera, under the name of Triungulinus (*Ann. des Sc. Nat.* 1828). Latreille at first adopted the opinion of Mr. Kirby, but subsequently that of De Geer. Walckenaer has collected all the facts

known relative to this insect, in his *Memoir upon Halictus*, p. 83. and fig. 1. *f.*; and his observations upon the constant uniformity and minuteness of size of this supposed larva, which nobody had ever seen either grow or undergo any metamorphosis, seem to warrant the opinion that it cannot be the larva of the Meloe. Latreille, indeed, suggests that these larvæ mount upon the bodies of the bees, in order to be carried by them into their nests under ground, where they feed upon the food laid up in store for the bees' young, which opinion is also adopted by Erichson and Brandt; but all these authors neglect the fact, that the larvæ are found upon Syrphidæ and Muscidæ, as well as upon bees; as well as the express statement of Geoffroy, that the larva of the Meloe "ressemble beaucoup à l'animal parfait. Elle est de même couleur, grosse, lourde, n'ayant que la tête écailleuse, et tout le reste du corps mol. On la trouve enfoncée dans la terre, où elle fait sa métamorphose" (*Hist. Abrég. Ins.* Paris, i. 377.),—a statement confirmed to me (as regards the full-grown larva,) by G. Newport, Esq., who has made a valuable series of observations on this insect. Swammerdam, also, treats Gœdart's statement as improbable: moreover, the extreme agility of this larva is quite at variance with the character of the imago; and it is to be observed, that in this respect there is in general an agreement between the larva and imago. I shall only add, that although the mouth of these larvæ (as I have shown in detail in a Memoir read before the Entomological Society, and as represented in figures 34. 22. and 23.) is mandibulated, it is quite unlike that of any other larva with which I am acquainted, and that the mouth of many of the Anoplura are also mandibulated. (See also *Bull. des Sc. Nat.* Septemb. 1828.)

Among the exotic genera, are especially to be noticed Gnathium and Nemognatha, in which the maxillæ of the males are terminated by a long and slender pilose filament like the tongue of a bee and Cerocoma, which have the antennæ 9-jointed, the joints in the male being irregularly produced into various sized lobes, and those of the female being simple; in both sexes the terminal joint is large, and probably consists of three joints soldered together.

The seventh family, SALPINGIDÆ * *Leach*, is of small extent, distinguished by having the head produced in front into a snout, or flattened rostrum (*fig.* 35. 1. Salpingus ruficollis), with the antennæ

Fig. 35.



(*fig.* 35. 2.) inserted at the base and in front of the eyes, which are always entire; the body is generally oval, or oblong and depressed; the legs slender. In the typical genus, the mentum is transverse, as well as the labrum (*fig.* 36. 2.), which is slightly emarginate in front; the palpi are filiform and short; and the maxillæ distinctly bilobed (*fig.* 36. 1.). The penultimate joint of the tarsi is bilobed (*fig.* 35. 3.). The species are of small size, sometimes brightly coloured, and are found either beneath the bark of trees or in flowers. These insects are evidently allied on the one hand to the Œdemeridæ, and on the other to the Curculionidæ; indeed, Mr. Stephens has removed them from the Heteromera, and placed them next after the Bruchidæ, amongst the Tetramera.

The eighth family, ŒDEMERIDÆ † *Leach*, comprises a greater number of species than the preceding family, having the body

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* BIBLIOGR. REFER. TO THE SALPINGIDÆ.

Clairville. Ent. Helvetique, vol. i.
Charpentier. Horæ Ent.
Guérin. Icon. R. An.
Chevrolat, in Ann. Soc. Ent. France, vol. ii. (G. Homalorhinus.)
Paykull, Gyllenhal, Marsham, Stephens, Curtis, &c.

† BIBLIOGR. REFER. TO THE ŒDEMERIDÆ.

Schonherr. Syn. Ins. vol. iii. (Nothus.)
Westwood. Zool. Journ. vol. v.
And the works of *Gyllenhal, Paykull, Stephens, Olivier, Panzer*, &c.

often long and narrow, with the elytra broader than the head and thorax, (*fig.* 35. 4. Œdemera cærulea ♂.); in others the body elongate-ovate and subdepressed; the antennæ moderately long and filiform, never thickened at the tips, and varying in number of joints from 10 to 12; the head more or less elongated in front, and inserted deeply in the thorax, without any distinct neck (*fig.* 35. 5.); the elytra are often entire, but occasionally attenuated at the tips. The posterior femora in the males of some of the species are greatly incrassated (as in *fig.* 35. 4.; *fig.* 35. 6. representing the posterior leg of the opposite sex.). The insects are not, however, saltatorial; the palpi are variable in form, in some being nearly filiform, and in others terminated by a large and broad securiform joint (*fig.* 35. 19. maxillary; 35. 20. labial palpi of Nothus); the mandibles are nearly triangular, terminated by a bifid point, and internally furnished with a membranaceous margin; one of the posterior tarsi is represented in *fig.* 35. 7. These insects are of a moderate size, and generally of lively colours. In the perfect state they frequent flowers, especially those of the umbelliferæ, and hedges: they fly with agility, but their motions in walking are rather slow; they are, however, enabled to retain firm hold upon the leaves and stems of plants, by means of their dilated tarsi.

The insect known in the English collections under the name of Œ. podagrariæ*, appears to differ in its habits, flying in the evening, and, as we learn from Mr. Bird, being attracted by lighted candles at night (*Ent. Mag.* ii. 41.). Mr. Dale has also taken it at the roots of apple trees.

Latreille states that the transformations of these insects are unknown; I am enabled, however, by the kindness of Mr. Ingpen, to give the following notice of the larva of Œd. (Ischnomera) viridissima *Mshm.* In April, 1827, he discovered in the most exuding wounds of young poplar trees near Somer's Town, several specimens of that insect, and also of a larva (*fig.* 35. 8.) in company therewith; I was unable to rear these larvæ, although one of them commenced forming a cell. I am unable, therefore, positively to assert that this is the larva of the Œdemera, although neither Mr. Ingpen nor myself felt any doubt that such was the fact. The body of the larva is fleshy, and of a whitish-buff colour, except the head, which is more corneous;

* Great confusion exists as to the name of this insect. It cannot be either the podagrariæ of Linnæus, the testacea of Fabricius, the melanocephala of Panzer, or the simplex of Linnæus. In Dejean's cabinet it stands under the genus Dryops.

and broader than the other segments, which are gradually narrowed to the extremity: it indeed bears some resemblance to the larvæ of the Longicornes, but in the size of the head and legs it is sufficiently different; the head (*fig.* 35. 9.) is transverse, with the jaws horny, reddish coloured, and advanced, forming a triangle in front when shut; the antennæ and palpi are slender (*fig.* 35. 10. represents the maxillæ and labium); the legs are short, scarcely extending beyond the sides of the body. The five anterior segments are furnished on the upper side with a double series of small oval plates (*fig.* 35. 12.). The fifth and two following segments are also severally furnished on the under side with a pair of small fleshy prolegs or tubercles (*fig.* 35. 11.); the sides of each segment are also furnished with a fleshy contraction; and the terminal segment is entire above, but with an apparent tubercle on the under side.

These insects appear to be allied to the Telephori on the one hand, and to Zonitis on the other. They are also in some respects related to the Melandryidæ, with which they agree in having the antennæ exposed at the base, and in the form of the mandibles and maxillary palpi.

Latreille considers that it might not be unnatural to place the Horiidæ, which have the posterior femora clavate, immediately after Zonitis and Sitaris (at one end of the Cantharidæ), and to pass from thence to the Œdemeridæ and Mordellidæ, from which by Scraptia the passage to the Notoxidæ might be effected. I have partially adopted these views; the affinity of Scraptia, however, appears rather to be towards the Serropalpi.

The remarkable and very rare genus Nothus has much perplexed entomologists as to the distinctions of the sexes as well as of the species. Mr. Curtis has figured a small insect of this genus with simple posterior legs, which he is inclined to regard as a variety of the male, which can scarcely be correct. In the British Museum collection is an English female specimen of this genus, overlooked both by this author and Mr. Stephens, resembling Mr. Curtis's right hand figure, but having a fulvous thorax with two red spots.

The ninth family MELANDRYIDÆ* *Leach* (or the Securipalpi or Serropalpi of Latreille) are especially distinguished by the large size

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* BIBLIOGR. REFER. TO THE MELANDRYIDÆ.

Bosc. Observ. sur le Serropalpus, Act. Soc. Hist. Nat. Paris, tom. i.

Rhen, in Schneider's Mag. vol. ii.

of the three terminal joints of the maxillary palpi, which are often serrated and deflexed (*fig.* 35. 15. head of Serropalpus.). The antennæ are occasionally inserted in a notch in the eyes, and are generally short and filiform; the mandibles (*fig.* 35. 17.) are short and often bifid at the tips (*fig.* 35. 16. represents the labrum, and 35. 18. the labium of Serropalpus); and the tarsal claws are entire. The body is generally elongate and subcylindric or depressed (*fig.* 35. 13. Melandrya Caraboides), not unlike that of the Elateridæ; occasionally it is more ovate, with the head inflexed, and the thorax broadest behind; the head is not advanced into a rostrum, and the posterior femora are never clavate; the penultimate joint of the tarsi is generally bilobed, at least in the two anterior pair of legs; in those species in which it is entire, the hind legs are formed for leaping, being long and compressed with slender tarsi.

These insects chiefly reside beneath the bark of trees. It is in such situations that I have observed the rare Phloiotrya (Serropalpus) rufipes, the larva of which (under the name of Xylita buprestoides) is described by Mr. MacLeay in the *Horæ Entomologicæ* (vol. ii. p. 464.) as belonging to the Thysanuriform, but approximating to the Iuliform larvæ. It is whitish, elongate, scaly, thickest at the middle and tail, convex above, concave beneath; the head semiglobose, short triarticulate antennæ, mandibles short, but acute; the second segment of the body large, subthoraciform, and apparently composed of two segments; anterior feet large, compressed, and hooked, and extending nearly to the top of the head; the two posterior pairs much smaller, the third segment of the body shortest; the remainder gradually lengthened to the twelfth, which is convex, with strongly impressed points; and the thirteenth segment is furnished with two sharp horny appendages curved upwards. It was found, in company with the perfect insect, in the solid wood of an old oak in Hampshire, by Mr. Samouelle. (See also Mr. Children's notice of a nearly similar larva in the *Appendix to Captain Back's Voyage to the North Pole*, 1836.)

Schall. Act. Hall. vol. i.
Hellenius. Act. Holm. 1786.
Schellenberg. Ent. Beitrage. t. i.
Schonherr, in Act. Holm. 1809.
Walker. Ent. Mag. vol. iv. p. 83.
And the general works of *Gyllenhall*, *Paykull*, *&c.*

Mr. Ingpen has communicated to me a larva (*fig.* 35. 14.) found by him in damp rotten wood at Coomb Wood, which so nearly resembles the description of the larvæ of Phloiotrya rufipes, that I am induced to regard it as that of Melandrya caraboides, which I have often taken there. It will be seen that it very closely approaches the larvæ of some of the Helopidæ. Mr. Shuckard has recorded a curious circumstance respecting this insect, which would appear to indicate parasitic habits, stating that he had taken it repeatedly thrusting its abdomen into the cell of Chelostoma maxillosa, with the ovipositor exserted to the utmost length. I should suppose, however, that Mr. Shuckard merely observed the insect on the outside of the paling in which the burrows of the Chelostoma were made, without having actually observed the act of oviposition *in* the cell of this bee, and should rather presume that the female had merely taken advantage of the hole thus made to introduce its eggs into the rotten wood.

From the description given by Gyllenhall of the larva of Calopus serraticornis, I am induced to place it in this family rather than in the Œdemeridæ, with which it has been associated. It is as follows: "Larva pollicaris hexapoda alba glabra, anterius latior, capite parvo brunneo incisuris undecim profundis, præter caput et caudam, quorum primum seu thoracis majus læve, reliqua margine antico punctata; supra caudam cornicula duo recurva, apice nigra." (*Gyll. Nov. Act., Upsal*, vol. 6., and *Ins. Suec.* ii. p. 513.)

I am indebted to J. A. Power, Esq., of Clare Hall, Cambridge, for the larvæ (*fig.* 35. 23.) and pupæ (*fig.* 35. 25.) of Orchesia micans (*fig.* 35. 21.), found in moist Boleti. They have also been described and figured by Mr. G. R. Waterhouse in the *Ent. Mag.* vol. 2. p. 376. The larva is of a fleshy texture, except the head (*fig.* 35. 24.), which is horny, and rather large, with very minute antennæ; the body is subconvex and whitish; the segments transverse, and of equal size, the last alone being smaller and simple; the legs six in number, and small. It is very sluggish in its motions; the pupa is elongate, and is remarkable for having the prothoracic shield (mistaken by Mr. Waterhouse for the head) dilated on each side, and covering the head, with erect hairs, and for the size of the rudimental elytra, which entirely cover the hind legs. In its preparatory states, therefore, this insect materially recedes from the typical Melandryidæ, and approaches Mordella, with which it also agrees in the curious skipping, shrimp-like motions of the imago (*fig.* 35. 22. hind leg); but the structure of the mouth is much more analogous to that of

Melandrya. M. V. Audouin has also observed the transformations of this insect, and has ascertained that it is attacked by one of the aberrant Ichneumonidæ (Perilitus similator *Wesm.*). I have also reared this parasite from it. Curtis also mentions Euphorus orchesiæ and Meteorus orchesiæ among the aberrant Ichneumonidæ.

The tribe ATRACHELIA or second primary division of the Heteromerous Coleoptera, is distinguished by the breadth of the hinder part of the head, so that this part of the body is immersed into the prothoracic cavity as far as the eyes; the anterior coxæ are small and globular; the claws of the tarsi are generally entire; the tarsal joints not dilated, and the elytra of a firm consistence. In many of the species, the inner edge of the corneous mandibles presents a deep incision covered with membrane, and the maxillary palpi are generally terminated by a large hatchet-shaped joint.

These insects are generally slow in their motions, and of dark colours; they are frequently found on the ground, and in obscure situations, although the Helopidæ and Cistelidæ, which are evidently the most nearly allied to the preceding groups, frequent trees and flowers; there is, however, a general uniformity in the structure of the larvæ of all these insects, proving their near relationship, except those of the Diaperidæ.

This division comprises the families Cistelidæ, Helopidæ, Tenebrionidæ, Diaperidæ, Blapsidæ, and Pimeliidæ: Latreille has raised Cossyphus (with Helæus and Nilio) to an equal rank with these groups; but the structure of the mouth of these genera indicates their affinity with the Helopidæ, which last are so nearly allied in many respects to the Tenebrionidæ, that Mr. Curtis gives the typical genus Helops as an example of that family.

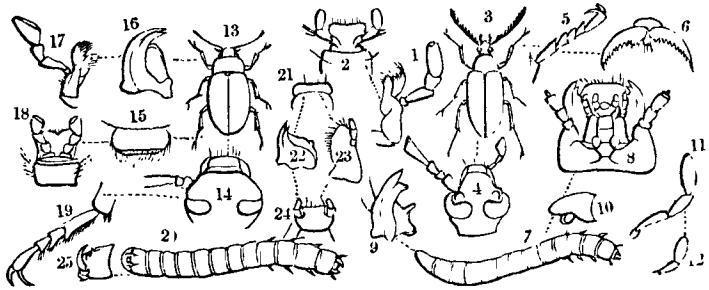
The first family CISTELIDÆ* (Cistelides *Latr.* or Xystropides *Solier*) is of small extent, and very closely allied to the following family,

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* BIBLIOGR. REFER. TO THE CISTELIDÆ.

Solier, in Ann. Soc. Ent. France, 1835, No. 2.
Perty. Del. An. Art. Bras.
Germar. Sp. Nov. Ins.
Klug. Madagascar Coleoptera.
Gyllenhall, Stephens, Olivier, Fabricius, &c.

Fig. 36.



from which it differs in the irregularity of the tarsal claws, which are denticulated (*fig.* 36. 6.), which character gives it some relation with some of the foregoing families; the antennæ are also unconcealed at the base by the margin of the head (*fig.* 36. 4. head from above); the palpi often terminate in a large triangular or hatchet-shaped joint, but in others are filiform (*fig.* 36. 11. maxillary, 36. 12. labial palpi of Cteniopus sulphurea); the mandibles are cleft, or bifid at the tips, or entire, and the tarsi are not dilated (*fig.* 36. 5.); the elytra are of a less firm consistence than in the following families.

Many of these insects are found upon flowers and in hedges. The larvæ reside in rotten trees. I am indebted to the Rev. A. W. Griesbach, for an opportunity of examining the larva (*fig.* 36. 7.) of Cistela Ceramboides (*fig.* 36. 3.), which he found in March in a pollard oak on Wimbledon Common, and from which the imago was reared in the following May; the larva is very long, subcylindric, scaly, and very much resembles some of the larvæ of the Elateridæ; the antennæ are short and three-jointed, the terminal joint being furnished with a very minute tubercle, or retractile fourth joint; the head (*fig.* 36. 8.) is reddish, the mouth black (*fig.* 36. 9. mandible); first segment pale buff, the remaining segments dull greenish, with the posterior margin red; the terminal segment (*fig.* 36. 10.) is quite simple, and of a somewhat conical form, and of a buffish colour. It twists about when alarmed, and walks backwards very well. Mr. G. R. Waterhouse has figured the details of the trophi of this larva (*Ent. Trans.* v. 1. pl. iv. f. 2. *a—e.*). The last named gentleman has also figured the larva of Eryx niger (*loc. cit. fig.* 1.), which is of a yellowish white colour, with the head ochreous and corneous. It very closely resembles the preceding larva, differing chiefly, but slightly, in the structure of some parts of mouth. It is found in the vegetable mould of decayed oak trees.

Bouché has given figures of the larva and pupa of this insect, evidently taken from specimens in spirits, and consequently greatly attenuated; the pupa is distinguished by having the lateral margin of the abdominal segments furnished with a small flattened and spinose lobe. Kyber has also given an account with figures of the last named species in its different states in Germar's *Magazin der Entomologie*, vol. ii. tab. 1. *fig.* 8—11.

The larva and pupa of Mycetocharus axillaris, found in rotten apple trees, have been figured by Bouché (*Naturg.* pl. 10. f. 1—11.); but do not offer any apparent variation from those of Eryx niger. The larva of Myct. scapularis, from rotten oak, is figured by Mr. G. R. Waterhouse (*Ent. Trans.* i. pl. 5. f. 3.), and also equally resembles the former. These larvæ are furnished with two anal prolegs.

Solier divides this family into two sections, Cistelites (with bifid mandibles, and securiform maxillary palpi) and Cteniopites, with entire mandibles and maxillary palpi scarcely securiform.

The second family HELOPIDÆ* *Stephens* (*fig.* 36. 13. Helops caraboides), consisting, however, of exotic species, is very extensive, chiefly distinguished from the preceding family by having the tarsal ungues not serrated, and from the following by the structure of the antennæ, which are filiform, and the elytra not soldered together; the head is short, and immersed as far as the eyes in the thoracic cavity (*fig.* 36. 14.); the antennæ are concealed at the base by the lateral margins of the head, with cylindrical or reversed conical joints, the third being the longest; the mandibles (*fig.* 36. 16.) are short,

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* BIBLIOGR. REFER. TO THE HELOPIDÆ.

Kirby, in Trans. Soc. Linn. vol. xii.
Griffith. Animal K. Ins.
Perty. Del. An. art. Bras. pl. 12, 13.
Hope, in Trans. Zool. Soc. vol. i. (Lyprops.)
Guérin. Icon. R. An., and Voy. Coquille.
Silberman. Rev. Ent. No. 2. (Odontopus.)
Fischer. Ent. Russ. vols. i. and ii.
Dalman. Anal. Ent. (Amarygmus.)
MacLeay, in King's Voyage to Australia.
Gistl, in Isis, 1831, No. 3. (Acropteryx.)

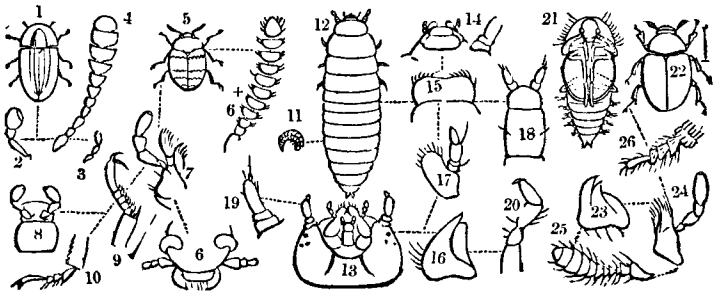
triangular, and bifid at the tips, with a large internal incision covered by membrane; the maxillary palpi are terminated by a large hatchet-shaped joint (*fig.* 36. 17. — 36. 15. represents the labrum, and 36. 18. the labium); the eyes oblong, or kidney-shaped; the legs rather long, and formed for running; the penultimate joint of the tarsi, at least in the posterior pair (*fig.* 36. 19.), is generally entire, or but slightly bilobed; the body is arched above, of a solid consistence, and generally of an oval or oblong form; the sexes present but little external variation. In the males of some species, however, the anterior tarsi are dilated.

These insects are generally much more active in their motions, and more gaily coloured than the following families; they are frequently found upon flowers, or under the bark of trees, where also their larvæ reside, and which are of a cylindrical form, smooth and glossy, with short legs, very much resembling those of the Tenebrionidæ. That of Helops cæruleus has been described and figured by Mr. Waterhouse (*Trans. Ent. Soc.* v. i. t. iv. f. 3., and my figure 36. 20.): it is found in the same situation as the larvæ of the Cistelidæ, and is of a yellowish white colour, elongate and cylindrical form, with the segments of nearly equal size; the antennæ very short, and 3-jointed; the legs very short; the penultimate segment is rugose, and the terminal one short, and armed with two diverging erect and acute spines (*fig.* 36. 25.). The parts of the mouth (*fig.* 36. 21. labrum, 36. 22. mandibles, 36. 23. maxilla, and 36. 24. labium) are very similar to those of the larva of Cistela ceramboides. Mr. C. J. Paget has recorded the injury committed by the larva of Helops violaceus in a window frame, where a colony had taken up their abode (*Nat. Hist. Yarmouth, Append.*).

There is but a single genus found in this country, viz. Helops *Fabr.* the species of which are considerably diversified in their general appearance. Amongst the numerous exotic genera, of which this family is chiefly composed, the genera Sphæniscus *K.* from Brazil, and Adelium *K.* confined to New Holland, are especially interesting; — the former from its striking analogy with some of the species of Erotylidæ, and the latter from its strong resemblance to some of the Carabidæ, whence the species have received the names of Ad. Calosomoides, Caraboides, Licinoides, &c. Sphærotus and Cnodalon in like manner resemble some of the Chrysomelidæ.

The small group COSSYPHIDES*, is arranged by Latreille in the section Taxicornes, but appears rather to enter the preceding family. It is composed entirely of exotic insects of anomalous forms, but in which the mouth nearly resembles that of the Helopidæ. Some of these insects resemble the flattened species of Peltis, having the body narrow, but with the margins of the thorax and elytra extended into a flattened shield all round the body: this is the case in Cossyphus (*fig.* 37. 1. C.Hoffmanseggii), which is further distinguished by having

Fig. 37.



the antennæ terminated by a 4- or 5-jointed club (*fig.* 37. 4.; *fig.* 37. 2. maxillary; and 37. 3. labial palpi). Mr. W. W. Saunders has published a short notice respecting an Indian species of this genus, in the *Trans. Ent. Soc.* (vol. i. p. 61.) found by him under the bark of the Mango (Mangifera indica), and Lichi (Dimocarpus Litchi), the remarkable flatness of the insect allowing it to creep into very narrow crevices, and its dull colour resembling that of the bark, and rendering it difficult to be observed. The New Holland genus, Helæus, is somewhat similar in form, but the thorax is advanced on each side, and meets in front over the head, forming an anterior excavation, exposing only its upper part. In the South American genus, Nilio, the head is exposed, but the body is of a hemispherical form like a Coccinella.

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* BIBLIOGR. REFER. TO THE COSSYPHIDES.

Kirby, in Linn. Trans. vol. xii., and in Zool. Journ. (Encephalus.)
Guérin and Percheron. Gen. des Ins. Col. pl. 11.
Latreille. Règne An. vol. iii. pl. 17.
Guérin. Icon. R. An. t. xxxi.
Germar. Ins. Sp. Nov.

The third family DIAPERIDÆ*, (*fig.* 37. 5. Diaperis boleti) is distinguished by the structure of the antennæ (*fig.* 37. 6*.), which are inserted beneath the lateral margins of the head (*fig.* 37. 6.), and are short, and more or less perfoliated or moniliform, and gradually or suddenly thickened at the tips; the legs are short, and formed for crawling, with the tarsal joints simple and entire (*fig.* 37. 9. anterior, 10. posterior tarsus); the body is generally of a quadrate or rounded form; the claws are simple; the head is not concealed; the thorax is quadrate, trapeziform, or subcylindric; the palpi in the typical genera are nearly filiform, the terminal joint being scarcely enlarged (*fig.* 37. 7. maxilla; and 37. 8. labium of D. boleti). From the internal structure of Diaperis, Hypophlæus, and Boletophagus, as observed by L. Dufour, this family is evidently closely allied to the Tenebrionidæ, notwithstanding the different structure of the antennæ and larvæ; the genera Uloma and Hypophlæus apparently forming the passage between the two families.

These insects are generally found in boleti or fungi, growing upon trees, &c., or under bark; others, however, are met with under stones.

I have discovered the larva of Platydema bicolor *Lap. and Br.* (Diaperis ænea *Panzer*), in company with the perfect insect, in considerable quantities during the winter, under the bark of rotten stumps, near Chiswick. The larva (*fig.* 37. 11. natural size; 37. 12. magnified) is of an oblong form, subconvex above, and narrowed at each extremity, especially towards the tail, which is terminated by a very minute joint, bearing two very short approximated spines at its extremity, with an anal proleg beneath. The body is scaly, and of an olivaceous colour, with a pale central line; the legs (*fig.* 37. 20. foreleg) and antennæ (*fig.* 37. 19.) are short; the mandibles (*fig.* 37. 16.) bifid; the tubercular eyes, three on each side, behind the antennæ.

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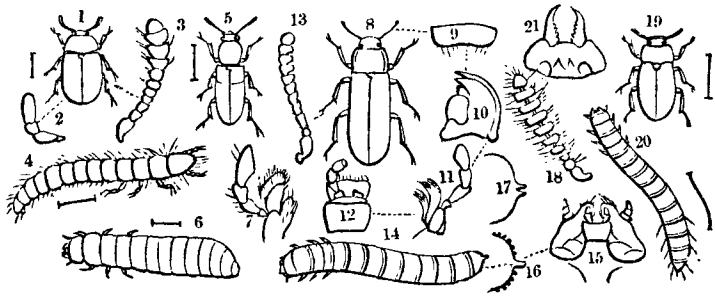
* BIBLIOGR. REFER. TO THE DIAPERIDÆ.

Laporte and Brullé. Monogr. du G. Diaperis (Ann. Sc. Nat. July, 1831).
Guérin. Icon. R. An.
Sturm. Deutchsl. Fauna.
Klug. Madag. Coleopt.
Chevrolat, in Silb. Rev. Ent. vol. i. 1833. (G. Oopiestus.)

(*Fig.* 37. 13. represents the under side of the head; 37. 14. front of the head on the upper side; 37. 15. labrum; 37. 17. maxilla; and 37. 18. labium of this larva). The pupa (*fig.* 37. 21.) is broader, with the abdomen also terminated by two larger acute diverging points, and the lateral margin of the abdominal segments provided with minute setose tubercles.

Dr. Hammerschmidt has figured the larva of Diaperis boleti in his work *De Insectis Agriculturæ damnosis, &c.* plate 1., but in a very unsatisfactory manner; it is represented as long, cylindrical, and furnished with six legs. I have also discovered under the bark of elm trees in Kensington Gardens, in company with Hypophlæus bicolor (*fig.* 38. 5.), specimens of a small larva (*fig.* 38. 6.) which I

Fig. 38.



have no doubt are those of that species, having the body of a whitish-buff colour, considerably narrower than that of Diaperis ænea, subconvex above, concave beneath, with the legs short; the terminal segment of the body small and entire, and the other segments of the body furnished with a few long hairs. Fig. 38. 7. represents the maxilla of H. castaneus. Bouché has described and figured the larva (*fig.* 38. 4.) of Boletophagus agaricola (*fig.* 38. 1.); it is elongate, semicylindrical, somewhat curved, and narrowed behind; the head rounded; the antennæ 4-jointed; the terminal segment small, rounded, and entire; the legs six in number, and short, as well as the anal proleg. It resides, as well as the perfect insect, in Boleti (*Naturg. der Ins.* 1. p. 191. pl. 9. f. 7.). Figure 38. 2. represents the maxillary palpus; and 38. 3. one of the antennæ of the perfect insect.

The genus Trachyscelis (*fig.* 37. 22. Tr. aphodioides) *Latr.* is remarkable for its very short antennæ, terminated by a 6-jointed oval club (*fig.* 37. 25.); the tibiæ are broad, triangular, and spinose, formed

for burrowing (*fig.* 37. 26. posterior tarsus); the anterior legs resembling those of Opatrum tibiale; the body is nearly hemispherical; in the structure of the mouth (*fig.* 37. 23. mandibles; and 37. 24. maxilla) it nearly approaches Opatrum, Phaleria, &c. This is therefore evidently its correct location. Mr. Stephens, however, unites it with the Lamellicornes, between Trox and Ægialia. The species are found upon the sea-coast, burrowing into the sand.

The genera Tetratoma and Leiodes placed by Latreille in this family, belong to the families Mycetophagidæ and Agathidiidæ.

The three remaining families, Tenebrionidæ, Blapsidæ, and Pimeliidæ, constitute Latreille's group named MELASOMA, in allusion to the black or obscure colours of the species, of which it is composed. These families have the following characters in common; the tarsi and tarsal claws are entire; the head is never narrowed behind into a neck; the antennæ are rather short, moniliform, or but slightly thickened at the tips, inserted beneath the produced lateral margins of the head; the third joint being generally elongated; the mandibles short and triangular, with the tip bifid; the internal lobe of the maxilla is often armed with a corneous tooth; the eyes oblong, and but slightly elevated, a circumstance considered by M.M. de Serres as indicating their darkling habits, many species avoiding the light, and living in cellars, stables, &c. (whence the origin of the generic name Tenebrio); others are found upon the ground, or under stones in sandy places: they are seldom or never found upon plants or flowers, and are very slow in their movements. In the Linnæan system they constitute the greater part of the genus Tenebrio.

The fourth family, TENEBRIONIDÆ * *Leach*, is distinguished by having the elytra not soldered together, with the wings fitted for

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* BIBLIOGR. REFER. TO THE TENEBRIONIDÆ.

Guérin. Icon. R. An. pl. 30., Voy. Coquille and Mém. Melasomes in Mag. de Zool.

Sturm. Deutchsl. Fauna.

flight. The body is generally oblong (*fig.* 38. 8. Tenebrio molitor) or ovate; depressed, or but slightly elevated; the thorax square or trapeziform, and as broad behind as the base of the elytra; the palpi are enlarged at the tip; the last joint being generally hatchet-shaped; the mentum is narrowed at the base (*fig.* 38. 12.), exposing the base of the maxillæ, of which the internal lobe is mostly unarmed (*fig.* 38. 11.; *fig.* 38. 9. labrum; 38. 10. mandible; and 38. 13. one of the antennæ of T. molitor.

The insects of this family are much more widely dispersed than those of the two following, many of the species being apparently attendant upon mankind, as the various Ulomæ, Tenebriones, &c., which feed upon wheat and flour; of these the beetle (Tenebrio molitor *Linn.*), whose larva is known by the name of the meal worm, is the most common, and may also be regarded as the type of the family. This insect frequents bake-houses, corn-mills, granaries, &c., doing much damage by devouring meal, bran, flour, &c. It is also very destructive to ship-biscuits packed in casks, which when opened are found eaten through in holes by these insects, and their larvæ.* The latter (*fig.* 38. 14.) are about an inch long, of a cylindrical and linear form, very smooth and glossy, of a fulvous colour, consisting of twelve segments, exclusive of the head, which is provided with short trophi, (*fig.* 38. 15. maxillæ and labium), and a pair of very small antennæ; the first segment of the body is larger than the following; the terminal segment is semicircular, slightly serrated at the edges, and terminates in a single point in the larva of Tenebrio molitor (*fig.* 38. 16.). On its under surface, it is provided with a small anal proleg; the

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Fischer. Ent. Russ. vol. ii.
Perty. Del. An. art. Bras. and Obs. Coleopt. Ind. Orient.
Griffith. An. Kingd. pt. Ins.
Hope, in Trans. Entom. Soc. vol. i.
Knoch. Neue Beitrage.
Dalman. Annal. Entomol.
Germar. Nov. Spec. Insect. p. 146.
Steven. Tentyriæ et Opatra. Mem. Soc. Imp. Moscow, vol. vii.
Besser. Addit. et Observ. in Tentyrias et Opatra, Mem. Soc. Imp. Mosc. t. viii.
Lamarck. Annal. du Mus. d'Hist. Nat. t. iii. (Chiroscelis.)
Olivier, Stephens, Gyllenhall, Fabricius, &c.

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* See Joyeuse, *On Worms destroying Sea-Biscuits;* Dryander, *Bibl. Banks.* 544.

ordinary legs are short. This larva changes its skin several times, avoids the light, and at length assumes the pupa state, without forming any cocoon, the imago appearing at the expiration of about six weeks, at first being of a reddish colour, but shortly afterwards assuming its black hue. The larvæ of these insects are greedily devoured by nightingales and other insectivorous birds, and are accordingly bred by bird-fanciers; it is necessary to keep the vessels in which they are placed firmly closed, or they make their escape, neither wood nor cloth being sufficiently strong to prevent them from boring their way through. The larva and pupa of this insect have been figured by Sturm in the 2d vol. of his *Deutchslands Fauna* and by *Frisch*, vol. i. pt. 4. t. 1.

De Geer has also illustrated the transformations of a species of this genus, which has been regarded as the Tenebrio molitor, but the extremity of the body is terminated by two short conical spines (*fig.* 38. 17.), and Mr. Curtis having represented the larva of T. obscurus thus organised, it is evident that De Geer's figures must be referred to this species. Mr. Curtis says, "This insect probably does more damage than the common one, for T. molitor prefers damp and damaged flour, whilst the larvæ of T. obscurus prefer that which is dry and sound." The insect is found in all its stages at the same time, and from an observation of Gyllenhall it is probable, that it has been introduced into Sweden by commerce.

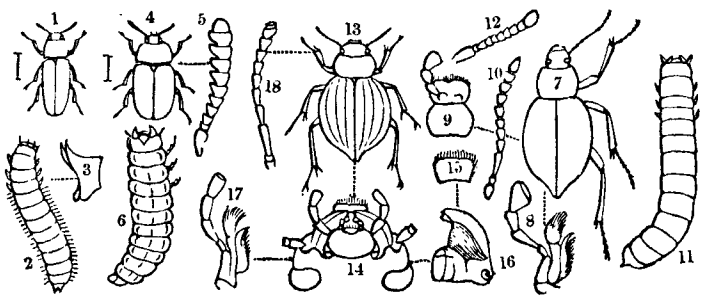
The larva of Tenebrio molitor, as we learn from Acrel (*Nov. Act. Upsal*, v. 6.), has been occasionally discharged from the human body in a living state, having been probably introduced with the food. In Forskal's *Descriptiones Animalium, &c.* (Havniæ, 1775.) are contained notices of the medicinal properties of Tenebrio polychrestes, and of the habits of T. arundinaceus; it is probable, however, that these insects belong to other groups. A Brazilian species, T. grandis, found beneath the barks of old trees, ejects from the extremity of its body a caustic fluid to the distance of more than a foot. Other smaller species found in the same country entirely cover themselves with this fluid. (Lacordaire.)

The genus Sarrotrium is well distinguished by the remarkable structure of its antennæ (*fig.* 38. 18.). I have generally found the typical species S. muticum in sand-pits.

The species of Uloma are very similar in their habits to the Tenebriones, and it is not improbable that the British species have

been introduced into this country with foreign flour One of the species, U. cornuta, is distinguished by the very large size of the horn-like mandibles of the males (*fig.* 38. 21.). Mr. Bainbridge has found it alive in bakehouses in London. In the same situation Ul. (Alphitobius *St.*) fagi (*fig.* 38. 19.) has been found by W. Longman, Esq., to whom I am indebted for specimens of the insect and its larvæ (*fig.* 38. 20.), which closely resembles that of Tenebrio; but is more elongate and narrow, with the terminal segment of the body unarmed. Mr. Ingpen has in like manner discovered Stene ferruginea (*fig.* 39. 1.) and its larva in bran. The latter (*fig.* 39. 2.) is

Fig. 39.



not so cylindrical, and somewhat broader in proportion to its size than the meal worm, and the body is terminated by two acute conical, diverging, and recurved spines, arising from the terminal segment, which has also on its under side two fleshy and white anal prolegs (*fig.* 39. 3.). This species, however, is more general in its habits than the preceding, since I have frequently discovered both the imago and exuviæ of the larva in the bodies of old and ill preserved specimens of exotic insects.

The larva of Crypticus glaber *Dej.* is described by Bouché (*Naturg. der Ins.* i. 191.) as very closely resembling that of Helops; it is cylindrical and filiform, with four spines at the extremity of the terminal segment. It is found in the autumn and winter in rotten willows.

The species of Upis are found in rotten boleti, or other vegetable matters. I have detailed the natural history of a South American species found, with the exuviæ of the larva, in the interior of a large nut, in a memoir read before the Entomological Society.

Count Fischer de Waldheim (*Oryctographie du Gouv. de Mosc.* fol. 1830.) has figured the larva (*fig.* 39. 6.) of Opatrum pygmæum? *Dej.*

(*fig.* 39. 4., 39. 5. antenna), which is of an elongated subdepressed form, and apparently fleshy; the head rather broad, the legs rather short, and the body gradually narrowed towards the tail, which is entire. The species of this genus reside in sandy situations: the Rev. J. Burrel, however, states that the Op. tibiale had been found in great profusion upon the Lichen rangiferinus (*Ent. Trans.* old series, i. 312.). It is probably more nearly related to Diaperis.

Amongst the exotic genera may be mentioned Heterotarsus *Latr.*, in which the ante-penultimate tarsal joint is bilobed, and the penultimate joint very minute, as in the Pseudotetramera. The genera Toxicum and Antimachus are remarkable for the horns or spines with which the head or thorax, or both are armed; Catopiestus piceus *Perty*, from Java, has the body scarcely thicker than a card. The genus Chiroscelis *Lam.*, has very much the appearance of a large Scarites, with broad palmated anterior tibiæ, and the antennæ terminated by a large globular joint. This insect has been considered to be capable of emitting light from a patch of pale colour on the abdomen; but M. Percheron has disproved this observation, showing the spot to be a sexual character, and to be opaque (*Silberm., Rev. Ent.*, vol. iii. No. 13.). But the most singular genus, which, indeed, ought perhaps to be considered as the type of a distinct family, is the North American Phrenapates of Kirby (figured in Griffith's *An. K.*); the tibiæ are dentate, like those of the Lucanidæ; the antennæ short, and terminated by a 3-jointed club; the mandibles very large, porrect, and dentated (somewhat as in Uloma cornuta); and the head armed with an erect horn; the palpi are filiform, and the maxillæ terminated by a slender corneous lobe. M. Solier has united it with Trictenotoma, and G. R. Gray with the Bostrichidæ, to neither of which groups does it appear to me to have any affinity. I am indebted to M. Gory for this curious insect.

The fifth family BLAPSIDÆ* *Stephens*, corresponding with Latreille's Blapsides, and composing, with the addition of the terminal genera of

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* BIBLIOGR. REFER. TO THE BLAPSIDÆ.

Kirby, in Trans. Soc. Linn. vol. xii.

Guérin. Mém. sur les Melasomes, in Mag. de Zool.

Solier, in Ann. Soc. Ent. de France, 1834. *et seq.*

his Pimeliares (forming his last division, *R. An.* v. p. 11—13.) the division Phaneroglosses of Solier (*Ann. Soc. Ent. Fr.* 1834, p. 502.), is distinguished by the elytra being generally soldered together; the wings being obsolete (*fig.* 39. 7. Blaps mortisaga); the maxillary palpi terminate in a large dilated and triangular joint (*fig.* 39. 8.); the mentum is narrowed at its base, exposing the external edges of the maxillæ, and arises from a narrowed portion of the jugulum; in some species the mentum is emarginate; the labium generally distinct; and the palpi 3-jointed (*fig.* 39. 9.); the mandibles bifid; the maxillæ having the internal lobe armed with a claw; the legs and antennæ (*fig.* 39. 10.) generally of moderate length and slender.

These insects are of a moderate size, of dark, or, more generally, black colour, and are found in damp and obscure situations. They are for the most part strangers to this country, a single genus Blaps, the type of the family, being found in this country. Several instances have been noticed, in which the larvæ (*fig.* 39. 11.) of the common species Blaps mortisaga, or churchyard beetle, has been discharged from the stomach. Of these, the most remarkable account is that published by Dr. Pickells in the *Trans. of Associated Physicians in Ireland*, vols. iv. v. and vi. 1824—1828, of a case of a woman, aged twenty-eight, who emitted as many as two thousand larvæ of this insect at various times, as well as one pupa and one imago; and which probably originated in an absurd and superstitious practice, which she had for some time followed, of drinking daily for a certain time a quantity of water mixed with clay, taken from the graves of two Catholic priests, and eating large pieces of chalk. One of these beetles was immersed repeatedly into spirits of wine, but revived after remaining therein all night, and afterwards lived three years. A similar case, in which, however, but a few larvæ were discharged, has been lately communicated by Robert Patterson, Esq., of Belfast, to the Entomol. Society; and from one of these larvæ I am enabled to give the accompanying figure, from which it will be seen that the larva of the genus very closely resembles that of Tenebrio, having the

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Fischer. Entom. Russica, vol. ii.
Germar. Ins. Sp. Nov.
Klug. Coleopt. Madagasc.
Thunberg, in Swed. Trans. v. 1814.
Guérin. Mém. sur les Melasomes.
Fabricius, Olivier, Schönherr, Herbst, &c.

terminal segment of the body semicircular, and slightly serrated with a terminal point.

According to Fabricius, the women in Egypt eat the Blaps sulcata, which is very common in that country, cooked with butter, in order to make them grow fat; it is also used as a specific against the ear-ach, and the bite of the scorpion.

Mr. Curtis has noticed a sexual peculiarity in the insect named in English collections Bl. obtusa*, namely, that in the males, the elytra are more acuminate, and that there is a tuft of yellow hair upon the middle of the second abdominal segment at the base. Dr. Heineken has, however, proved that these characters are those of the females (*Zool. Journ.* 18. p. 200.); and Olivier states, that in Pimelia striata *Fab.* the female has a round granulated spot in the same situation; by striking which against any hard substance she produces a rather loud sound, which serves to attract the male. In some other species of Blaps the same peculiarity is to be observed, and two spots of a similar nature and situation are observed in Chiroscelis, which Lamarck considered as indicating some luminous organ (*Latr. Hist. Nat.* x. p. 262.). Mr. Curtis has also made some observations upon the relations of these insects, considering them as "having fewer joints in the palpi" than Cychrus; such, however, is not the case; the maxillary palpi in Blaps being 4- and not 3-jointed, as represented by Mr. Curtis; the basal joint being distinct, although small.

In Cacicus americanus *Dej.*, *Solier*, the posterior tibiæ are employed in producing an acute sound, by rubbing them against the lateral margins of the elytra. (*Solier, Ann. Soc. Ent. Fr.* 1837. p. 217.)

The only British genus is Blaps, consisting of three indigenous species. The exotic genera are numerous, great numbers of species inhabiting the sandy deserts of Africa, &c.; but they do not offer any material subject for observation.

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* As Dr. Heineken has shown that this insect is not the obtusa of Fabricius, it would be advisable to retain Schæffer and Marsham's name lethifera.

The sixth family, PIMELIIDÆ* (or the Brachyglosses of Solier— Pimeliariæ *Latr.*, with the omission of the terminal section), is distinguished by having the elytra soldered together, the wings rudimental or obsolete (*fig.* 39. 13. Pimelia muricata, South of Europe); the palpi filiform, or with the terminal joint but slightly dilated (*fig.* 39. 17. maxilla), and not distinctly hatchet-shaped; the mandibles (*fig.* 39. 16.) are bifid at the tips; the maxillæ concealed by the mentum, which is very large, and not narrowed at the base, entirely occupying the space formed by the oral cavity; and the labium is either entirely concealed or only slightly produced (*fig.* 39. 14. underside of the head, *fig.* 39. 15. labrum, and 39. 18. antenna of Pimelia).

But few of this extensive family of beetles are found in this country; they are most abundant in southern and eastern Europe, and in the deserts of Africa. But little is known of their habits: they shun the light, and reside in salt or sandy situations, many frequenting the shores of the sea, particularly the Mediterranean. Their colours are black or obscure; they are uncommonly sluggish, and on being alarmed they emit a disagreeably fetid fluid, which in some species produces a

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* BIBLIOGR. REFER. TO THE PIMELIIDÆ.

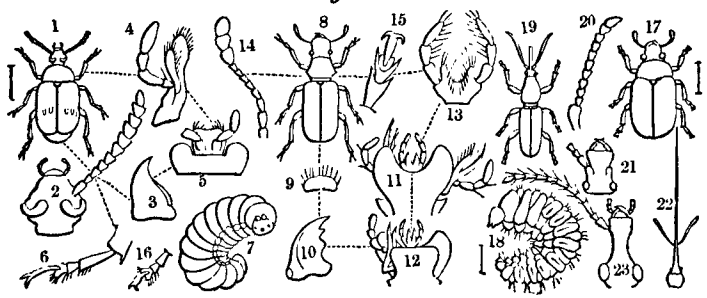
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Germar. Ins. Sp. Nov.
Sturm. Deutchsl. Fauna.
Duponchel. Mém. Soc. Linn. Paris, 1827. vol. vi. (Adelostoma.)
Klug. Symbolæ Physicæ, No. 2.
Erichson. Nova Acta. vol. xvii. (Insects of Meyer's Voyage.)
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Tauscher. Tentyriæ Ruthenicæ, Mem. Soc. Imp. Mosc. t. iii.
Stevens. Tentyriæ et Opatra Collect. Stevenianæ, in Mem. Soc. Imp. Mosc. tom. vii.
Besser. Ditto, in ditto, t. viii.
Lacordaire, in Ann. Soc. Ent. de France, 1837, p. 247. (on the localities of various Melasomata.)
Fischer. Bull. Soc. Hist. Nat. Moscow, 1837. No. 4.
Westwood, in Guérin's Mag. Zool. 1837. (g. Steira.)

coating of a whitish colour upon their bodies when dried. This is especially the case with the Eurychoræ, as we learn from M. Westermann's letter to Wiedemann, published in Silbermann's *Revue Entomol.* The Pimelia bipunctata observed by Latreille, inhabits the sandy shores of the Mediterranean, concealing itself in holes which it excavates with its legs. The chief (exotic) genera belonging to this family, are Erodius, Tentyria, Pimelia, Nyctelia, Asida, Akis, and Eurychora, the last having the body flattened, with the margins thin, and turned slightly upwards. Some few of the genera have only ten distinct joints in the antennæ as in Steira *W.* (*fig.* 39. 12.).

Sect. iii. PSEUDOTETRAMERA.

THE third general section of the Coleoptera comprises those beetles which have the tarsi apparently 4-jointed (*fig.* 40. 6. 16.)

Fig. 40.



although in reality consisting of five joints*, the fourth joint being so minute (*fig.* 41. 16.) as to have escaped the notice of the tarsal systematists, who, consequently, gave to these insects the sectional name of Tetramera, which, as previously observed (p. 44.), may be advantageously altered to PSEUDOTETRAMERA.

The minute joint above mentioned, as well as the basal portion of the terminal joint, are received between the lobes of the third joint, which

* In some species, however, the fourth joint appears quite obsolete. I can, *e. g.*, find no trace of it in Brachycerus (*fig.* 41. 6.), in which the third joint is not bilobed; but in the analogous unlobed and uncushioned tarsi of some of the Longicornes (Prionus Cumingii *Hope, Zool. Trans.* pl. 14. fig. 7.), the fourth joint is quite distinct.

is always more or less deeply emarginate at the extremity, and the underside of the three basal joints is generally thickly cushioned. The whole of these insects feed upon vegetable matter, and are found in their perfect state upon flowers, leaves, or the trunks of trees; the larvæ are fleshy grubs, being in the Rhyncophora entirely destitute of legs, or having them replaced by fleshy tubercles; in the Longicornes the six thoracic legs are distinct, but very minute, and in the Phytophaga they are of the usual size. Mr. MacLeay, indeed, speaks of the Apod or Vermiform larvæ, as consisting of the tribes having the Linnæan genera Bruchus, Curculio, Attelabus, Cerambyx, Leptura, Necydalis, and part of Dermestes and Tenebrio as the types, and considers the passage from this tribe as effected by means of Donacia to the Anopluriform larvæ, including Chrysomela, Cryptocephalus, Coccinella, Cassida and Hispa; thus forming these insects into two primary groups of the order: but as compared with the other primary groups, there appears to be a general affinity preserved through these insects; the Rhyncophora and Longicornes being allied in the structure of the internal feeding larva, and the relationship of the latter with the Cyclica being established by means of the Lepturidæ and Crioceridæ, and especially by the genus Donacia. It is true that Cerambyx and Leptura have nearly apod and internal feeding larvæ; and that the larvæ of the Crioceridæ and Chrysomelidæ are 6-footed, external feeders; the internal feeding larva of Donacia, which, in the perfect state, is referable to the Crioceridæ (although placed by Linnæus with Leptura), will probably be found to supply the link which here appears wanting. On the other hand, however, such genera as Megamerus, Rhaebus, Choragus, Bruchus Bactris, and Sagra, appear sufficiently to point out a passage between the aberrant Rhyncophora and Phytophaga; and Mr. Kirby has indeed made Anthribus and Clythra the connecting links between these two divisions. Latreille divides this section into seven groups or families, the Rhyncophora (Curculio), Xylophaga (Scolytus, &c.), Platysoma (Cucujus), Longicornes (Cerambyx), Eupoda (Crioceris), Cyclica (Chrysomela), and Clavipalpi (Erotylidæ). The major portion of the Xylophaga, such as the Mycetophagidæ, Trogositidæ, &c., have been already described amongst their more legitimate relations, the Necrophaga; whilst others, as the Bostrichidæ, have been considered as allied to the Ptinidæ; the only remaining group Scolytidæ, both in the structure of the larva and of the oral apparatus, being too closely allied to some

of the wood-boring weevils to be regarded as a distinct type of form. The Eupoda of Latreille do not appear to constitute a type distinct from Chrysomela (Crioceris and Cassida agreeing in the larvæ), and are united by Mr. Kirby under the appropriate name of Phytophaga, whilst the Clavipalpi are evidently most nearly allied to the Endomychidæ amongst the Pseudotrimera. Thus the section is reduced to the three primary groups

Rhyncophora. Head rostrated; antennæ short, generally elbowed. (Curculio *Linn.*)
*Longicornes.** Head not rostrated; antennæ long; body oblong. (Cerambyx *Linn.*)
Phytophaga. Head not rostrated; antennæ short; body short, rounded. } (Chrysomela *Linn.*)

The first goup or subsection, RHYNCOPHORA of Latreille, is distinguished at once by the front of the head being produced into a long snout or rostrum (*fig.* 40. 19. 22. 23.), at the extremity of which the mouth is situated. In the majority, the body is oval or rounded, and of a firm consistence; the abdomen is robust and broader than the thorax; the antennæ are short and elbowed, and often terminated in an oval club; they are inserted at the sides of the rostrum, and are variable in the number of their joints, in some being 12-jointed; the mandibles are small but robust; the palpi always very short and conical; and the third tarsal joint deeply bilobed; the legs are of a moderate length, with the posterior thighs often thickened and toothed.

This subsection is one of the most extensive of the groups of beetles; the species are for the most part of small or moderate size, few exceeding an inch in length, whilst many are very minute; in their colours they are very varied, some being ornamented with the most brilliant colours, chiefly arising from minute scales, with which the elytra, &c. are clothed; whence they have been called the representatives of the Lepidoptera amongst beetles.† They are

* As the other subsectional names are of Greek derivation, this subsection might be termed Eucerata, in allusion to the length of the antennæ.

† Latreille, in his *Hist. Nat.* &c., an. xii. vol. xi. p. 51., observes, "Les charansonites sont les Lépidoptères des insectes à étuis. Le parallèle est encore plus frappant, si l'on considère qu'ils ont aussi une sorte de trompe, que leurs larves dévorent nos végétaux, de même que celles des Lépidoptères, et que la forme de ces larves est également très différente dans les unes et les autres de l'insecte parfait. *La nature, en général, a un certain nombre de modèles qu'elle reproduit avec des modifications, dans tous les classes, et même dans les ordres;*" a doctrine lately promulgated by some of our naturalists as an unnoticed clue to the discovery of the natural system.

very generally distributed, being found in all climates, but mostly abounding in hot countries, as Brazil, &c.; where the luxuriance of vegetation affords them a plentiful supply of food, the entire family subsisting upon plants; the perfect insects being often injurious where they abound, by boring with their snouts into the buds and leaves of different plants, and feeding upon the interior parts, or the parenchyma; they are slow in their motions, and being unprovided with any means of defence, and of a timid nature, seldom quitting the plants upon which they reside, or making use of their wings; indeed, many species are entirely wingless. The larvæ are white and fleshy grubs, having the body thick, oblong, and arched, and being entirely destitute of legs, the place of which is supplied by fleshy tubercles placed upon the ventral segments; the head is rounded and scaly, and the jaws strong and horny, wherewith they are enabled to gnaw the various parts of the vegetables upon which they subsist, and which generally consist of the tender and interior portions of grains and fruits. Very few of these larvæ have, however, been observed. Those which have the jaws most robust, attack the harder parts of vegetables; that of Calandra palmarum attacking the stem of the palm tree; others, which have the trophi less robust, subsist upon the farinaceous parts of grains, or the pith of various plants; others feed upon leaves or flowers; some are leaf-miners, and a few reside in galls upon the leaves of various plants. The pupæ are sometimes enclosed in a silken cocoon spun by the larvæ, and, during this inactive period of their existence, the rostrum is folded upon the breast.

These insects are nearly allied, on the one hand, to some of the Heteromera which have the head rostrated and the tarsi dilated; and on the other, by means of the Scolytidæ, to some other wood-boring tribes, especially the Bostrichidæ (Apate, &c.); indeed, the resemblance between some of the species of Tomicus, and the smaller Bostrichidæ, as Rhyzopertha, is so great, that it is almost impossible without minute examination, to decide to which of the groups some of the species belong. By Latreille, indeed, the Bostrichidæ are made to succeed the Scolytidæ; whence, by some other Xylophaga, the passage to Trogosita, Cucujus, Parandra, and thence to the Longicornes, is supposed to be effected; but the structure of these intervening groups, and, especially of their larvæ, as I have already shown, clearly proves that this is not a natural transition, and interrupts the series of fleshy apod,

or subapod larvæ, and pseudotetramerous tarsi, which exist in the Rhyncophora and Longicornes. The precise links, therefore, by which the passage between these two groups is effected, still remain to be discovered. How far this may be effected by some of the smaller Longicornes with pilose bodies, such as Mesosa Curculionoides, remains to be ascertained. M. Chevrolat has shown me a remarkable Anthribideous species from Brazil, which he has named Pseudolamia scopicornis, which, as both names indicate, singularly resembles some Lamiæ.

This subsection corresponds with the Linnæan genera Bruchus, Attelabus, and Curculio, and is divided by Latreille into two primary sections — first, those with the labrum distinct, the rostrum short, broad, and flat, and the palpi filiform, (G. Bruchus); and second, those with the labrum not apparent, the head produced into a more evident snout, and the palpi minute and conical — (G. Attelabus and Curculio *L.*) Mr. Stephens has adopted these two divisions, giving to them the family names of Bruchidæ and Curculionidæ; but Schönherr, the indefatigable monographer of this difficult tribe of insects, has adopted a different mode of distribution in his *Genera et Species Curculionidum*, now in course of publication, and in the first volume of which the following classification is proposed: —

Ordo 1. Orthoceri. Antennæ not elbowed; the basal joint not very much elongated; and the rostrum without a lateral canal for the reception of the basal joint of the antennæ, comprising twelve divisions*: — Bruchides, Anthribides, Camarotides, Attelabides, Rhinomacerides, Ithycerides, Apionides, Rhamphides, Brenthides, Cylades, Ulocerides, and Oxyrhynchides.

Ordo 2. Gonatoceri. Antennæ geniculated; the basal joint elongated and inserted in an elongated canal at the side of the rostrum.

Legio 1. *Brachyrhynchi* (Curculiones *Fabr.*) Rostrum short and thick, with the antennæ inserted near its extremity, comprising ten divisions: — Brachycerides, Entimides, Pachyrhynchides, Brachyderides, Cleonides, Molytides, Brysopsides, Phyllobides, Cyclomides, Otiorhynchides.

Legio 2. *Mecorhynchi* (Rhynchænides *Fabr.*). Rostrum cylindric or filiform, more or less elongated, seldom shorter than the thorax; antennæ inserted between the base and the middle of the rostrum, and not at the tips, comprising eight divisions: — Erirhinides, Cholides, Cryptorhynchides, Cionides, Rhyncophorides (Calandra, &c.), Conoderides, Cossonides, and Dryopthorides.

By this arrangement the Linnæan Attelabi, and some few of his Curculiones, are united with his Bruchi so as to leave his genus Curculio nearly in its original extent, which latter cannot but be regarded as an advantageous step.

* These divisions appear to be of a lower rank than those which I have regarded as subfamilies in the Carabidæ, &c., having a similar termination in ides.

The characters derived from the structure of the mouth must, however, be regarded as of higher value than those of the antennæ; in which respect, therefore, the views of Latreille in separating the Bruchidæ from the rest appear to be most natural. The stirps may thence be divided as follows:—

Fam. 1. *Bruchidæ.* Palpi filiform (*fig.* 40. 4, 5.).
Fam. 2. *Attelabidæ.* Palpi conical (*fig.* 41. 13, 14.); antennæ not elbowed (*fig.* 40. 20.)
Fam. 3. *Curculionidæ.* Palpi conical; antennæ elbowed, (*fig.* 41. 8.)

The Scolytidæ differ too slightly from the latter to warrant their establishment as a distinct family.

The first family, BRUCHIDÆ *Leach*, is distinguished by having the rostrum short, broad, and flattened; the palpi are exposed and filiform, and the upper lip is distinct. This family comprises Schönherr's first, second, and third divisions, which may be reduced to the two subfamilies Bruchides and Anthribides.

The subfamily BRUCHIDES* is distinguished by the antennæ being filiform, or but slightly thickened at the tips, serrated or pectinated (*fig.* 40. 2.); the eyes emarginate; the rostrum broad and deflexed; the elytra do not entirely cover the abdomen, and the hind legs are often very large. *Fig.* 40. 3. represents one of the mandibles; *fig.* 40. 4. one of the maxillæ; 40. 5. the labium; and 40. 6. one of the tarsi of Bruchus granarius (*fig.* 40. 1.).

The perfect insects are found upon plants, appearing during the period of flowering, and depositing their eggs in the small and yet tender seeds of many leguminous plants, as well as in various kinds of corn, palms, &c. In these seeds the larva finds not only

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* BIBLIOGR. REFER. TO THE BRUCHIDES.

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Thunberg, in Nov. Act. Upsal. v. 7; in Goetting. Geli Anz. 1805., and Act. Holm. 1816.
Drapiez. Ann. Gen. Soc. Brux. v. t. 74.
Thon. Entom. Archiv. 1. part 3.
Hummel. Essais Entomol. vi.
Boheman, in Act. Mosq. vol. vi.
Germar. Ins. Spec. —— Illiger's Mag. iv. —— and Schneider's Mag. vol. v.

a secure habitation, but also a plentiful supply of food; and in which it subsequently undergoes its transformations until its arrival at the perfect state, when it makes its escape by gnawing a small round hole through the rhind of the seed, the larva having previously eaten its way to the inner surface of the seed, so that a thin pellicle alone remains; through which the larva makes a circular incision, leaving only a very thin pellicle in that part, through which the imago easily forces itself. One of these insects, Bruchus pisi, causes much injury to the edible pea by eating the interior of the seed, and making its escape about the period when the peas are ready for gathering. This insect, which is probably an imported species in this country, occasionally abounds to such an extent in some parts of North America, as to cause the total destruction of the crops of peas, &c.*

The Bruchus granarius *Linn.*, is also in this country often very destructive to the same vegetable, often depositing an egg in every pea in a pod. In general, the insect remains in the larva state until the following spring, but if the weather be very warm, the perfect insect appears in the preceding autumn; the larva has the curious instinct to leave the most vital parts of the seed until the last. The larva (*fig.* 40. 7. larva of B. ruficornis after Germar) is a soft white and fleshy grub, with a scaly head, and short strong jaws, with the legs obsolete or but very slightly developed. They have nine spiracles on each side of the body.

I have published some notes on the economy of two species of Bruchus, in the *Trans. Entomol. Soc.* (vol. i. p. xxiv.) and *Gardener's Magazine* (No. 87. p. 287.).

These insects are much more abundant in tropical climates than in our northern country. They attack the grains of the Gleditsia, Theobroma, Mimosa, Robinia, Pseudoacacia, and many other plants. I have also received specimens of the seeds of the Divi-divi (Cæsalpina coriarea), a very valuable Brazilian plant, infested by a small species. Germar has published a long notice of the economy of Bruchus ruficornis, which resides solitarily in the cocoa nut (*Mag. Entomol.* t. iii. p. 1. 7. tab. 1.); and M. Hummel has described another species, Br. Faldermanni, which attacks the seeds of a species of Macuna (one of the Leguminosæ), as many as 14 having been found in a single seed (*Essais Entomol.* No. vi. p. 10. 1827.). Latreille has also given an

* See Kalm's Travels, vol. i. p. 173

account of the habits of Bruchus curvipes in *Humboldt and Bonpland's Voyage to South America*, t. 16. f. 5. and which feeds upon the palm nuts. In Boddaert's *Dierkundig Mengelwerk*, 5th Stuck, is contained the description and figure of a large species of Bruchus with incrassated hind legs, together with its larva and pupa, and which resides in the cocoa nut.

The only British genus is Bruchus, of which several of the reputed indigenous species have probably been introduced with foreign grain into this country.

The second subfamily, ANTHRIBIDES*, differs from the Bruchides in having the antennæ distinctly and suddenly clavate (*fig.* 40. 14.), and the eyes entire; the rostrum is short, broad, and deflexed; the elytra do not cover the anus; and the second joint of the tarsi is generally large, the third being lodged between its lobes (*fig.* 40. 15.). The upper lip is distinct (*fig.* 40. 9.); the mandibles robust and toothed (*fig.* 40. 10.); but the lower parts of the mouth present a very curious structure, which does not appear to have been hitherto noticed. The labium and its palpi (*fig.* 40. 13.) are small, and arise from a large lunate horny piece, which has been considered by Latreille as the mentum (*fig.* 40. 11.); but on examining the inside of this organ, the true mentum (*fig.* 40. 12.) is found in the shape of a broad horny plate, between which and the lunate front of the jugulum the maxillæ work, as shown in various positions in figures

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* BIBLIOGR. REFER. TO THE ANTHRIBIDES.

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Knoch. Beitrage, i. p. 81.
Bohemann, in Act. Mosq. vi.
Schall, in Act. Hall. i. 287.
Thunberg, in Act. Holm. 1816. (4 sp. Bruchus). Ditto, in Act. Upsal. vii.
Perty. Delect. An., art. Braz.
Griffith. Anim. Kingd. Ins. pl 49.
Gaede, in Guérin's Mag. Zool. 15. (Acanthothorax).
Kirby, in Linn. Trans. 12.
Robert, in Guérin's Mag. Zool. 16. (Choragus, Anthribus pygmæus).
Fabricius, Stephens, Gyllenhall, Schönherr.

40. 11. and 12. These insects are of a larger size than the Bruchides, and are not so injurious in their habits, being generally found amongst old wood, or on the trunks of trees or in flowers. The largest British species Platyrhinus latirostris (*fig.* 40. 8.) inhabits fungi growing upon ash trees (as I am informed by W. Raddon, Esq.); upon wetting the outside of which the insects make their appearance externally, in order to sip up the moisture. C. C. Babington, Esq. has also found it in Sphæria fraxinea.

M. Dufour was the first entomologist who discovered the parasitical connection of some of these insects with the Coccidæ, having obtained the Brachytarsus scabrosus from a cocoon, or rather from what appeared to Latreille (*Hist. Nat. &c.* xi. 37.) to be the skin of a female Coccus. Dalman has also published a notice to the same effect in the *Swedish Trans.* for 1824, relative to an Anthribus of the size of a pea, of which the specific name is not given, but which is most probably the before-mentioned species, and of the certainty of which connexion no doubts could exist, as he placed an Anthribus with a Coccus in a bottle, and some time afterwards the pupa of an Anthribus was found in the body of the Coccus (*Bull. Sc. Nat.* Sept. 1825.). M. Vallot has also published a similar account in the *Annales des. Sciences Naturelles* for 1828; and Ratzeburg has given an account of the transformations and habits of Brachytarsus (Anthribus) varius (*fig.* 40. 17.), which destroys the Cocci in great numbers, and passes the winter in the pine forests, in his *Forst-Insecten*, from which the accompanying figure 40. 18. of the larva is taken.

In many of the species, the males are distinguished by the greater length of the antennæ, which sometimes exceed the entire length of the body. This is more especially the case with the remarkable Javanese insect figured by M. Gaede in the *Mag. de Zoologie* of M. Guérin, under the name of Acanthothorax longicornis, the male antennæ of which are not less than three times as long as the body; the prosternum is also armed with two strong teeth; the antennæ of the females are short. Schönherr has subsequently described it under the name of Mecocerus gazella.

A small tic insect, apparently belonging to this family, from the structure of the rostrum, has been described by Count Fischer de Walldheim (*Entom. Russ.* vol. ii.), and reared by him from the grains of the Robinia jubata, from the mountains of Altai in Siberia; and by Gebler from the Nitraria Schoberi; the elytra, however, are flexible;

and the claws bifid, thus resembling some of the Heteromera, amongst which it has also been placed; whilst Schönherr has not introduced it amongst the Rhyncophora, considering it more allied to Sagra. It is of a minute size, and of a sericeous green colour.

The genus Choragus of Kirby, whose natural situation has been equally the subject of speculation, (having been considered as allied to Cryptocephalus, Anobium and Cis,) appears to be more naturally related to the Bruchides or Anthribides, probably forming a link between them and the Cryptocephalideous Phytophaga. M. Robert has, indeed, lately published a description of it in Guérin's *Mag. de Zool.* ix. pl. 16., under the name of Anthribus pygmæus. It is of an oblong-ovate form (like a minute Cryptocephalus); the head but very slightly rostrated, and the three terminal joints of the antennæ elongated and thickened: the insect leaps well, although its hind legs are not dilated; the tarsi are formed as in the Bruchides (*fig.* 40. 16.). I have published some observations on this genus in the *Entom. Magazine*, vol. i. p. 290.

The genus Rhinomacer (*fig.* 40. 22. head of Rhinomacer) appears to form the connecting link with the rostrated Heteromera (Salpingidæ), but its tarsi are truly pseudotetramerous.

This genus, in connection with Rhinotia, &c., is placed by Schönherr in the midst of the Attelabidæ, between Rhynchites and Apion. The structure of its trophi, however, proves that it has no relation with Rhinotia, and that it is more nearly allied to the Anthribides. (*Latreille, Lettre sur le g. Rhinomacer, Journ. Soc. Médecine, &c., Bourdeaux*, vol. ii.)

The second family, ATTELABIDÆ *, is distinguished by having the antennæ not elbowed; the basal joint not being much elongated, nor inserted in a rostral canal; the upper lip obsolete; the palpi minute and conical; and the rostrum generally cylindrical and curved. This family corresponds to a certain extent with the Linnæan genus Attelabus, and with the fourth, part of the fifth, the sixth, and six following divisions of Schönherr's Orthoceri, which may conveniently be divided into two subfamilies, Brenthides and Attelabides, each being, consequently, of greater rank than the divisions bearing the same names in the work of the last-named author.

The first subfamily BRENTHIDES*, is composed entirely of exotic species of singular form, forming the genus Brentus *Fabr.*, having the body very long and narrow (*fig.* 40. 19. Arrhenodes septentrionis ♀ from North America); the head elongated and produced in front; with the rostrum varying in size and form according to the sex (*fig.* 40. 21. head of ♂); the antennæ are straight and filiform, with the last joint alone elongated (*fig.* 40. 20.).†

The subfamily is of small extent, there being scarcely a hundred species described by Schönherr. The species are of a moderate size, and generally of a black colour, varied with red or yellow spots and lines. The genus Arrhenodes of Steven offers a curious geographical peculiarity, as all the North American species of the family belong to it, as well as the only Europæan Brenthus, namely, Arr. coronatus *Germ.* (Brentus Italicus *Dej.*), which is found in Italy, where it has been taken by R. Spence, Esq., who informs me that he always met with it under the bark of trees. In like manner, Mr. R. H. Lewis informs me, that he found the Arrhenodes septentrionis, figured above, under the bark of felled trees, forming the cross layers of the

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* BIBLIOGR. REFER. TO THE BRENTHIDES.

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Griffith. An. K.
Latreille, in Dict. Class. d'Hist. No. xiv.
Dalman. Anal. Ent.
Perty. Del. An. art. Bras.
Guérin. Icon. R. An.
Schönherr, Herbst, Drury, Voet, &c.

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† The structure of the mouth is very curious, and has not yet been properly examined. The upper lip is obsolete, and the mandibles large and robust. In Eutrachelus Temminckii, the maxillæ are terminated by a long setose lobe, and the maxillary palpi are rather longer than the lobe, the second joint being considerably elongated; but I have not been able to trace the true structure of the instrumenta labialia, which are covered by a large horny lunate plate, as in Anthribus; but the labium and palpi are not exposed as in that group, and there is a horny organ of curious structure within the mouth.

"Corduroy Roads" in the great Huron track; and Dr. Thaddeus W. Harris, librarian of Harvard University, has also informed me, that "the larvæ inhabit the solid trunks of oaks, which they attack immediately after the trees have been cut down for timber or fuel: they do not perforate living trees; they are very singular in their form and habits." M. Lacordaire discovered the insects of this family, which inhabit Guiana, burrowing under the bark of trees (*Ann. Soc. Ent. Fr.*, vol. i. No. 4.); and Professor Savi informed Latreille (*R. An.* vol. v. 75.), that the Italian species above-mentioned resided in the colonies of a species of ant, which takes up its quarters under the bark of trees.

Some of the most extraordinary species of Rhyncophorous insects compose the South African g. Antliarhinus, in one sex of which the rostrum is nearly three times as long as the body, porrected, and as thin as a fine needle (*fig.* 40. 22.). Schönherr regards these individuals as females, and considers this genus as most nearly allied to Brenthus and Cylas, rather than to Balaninus, near which it was at first arranged. Thunberg (*Nov. Act. Scien. Upsal,* vol. iv. p. 29.) has described the female of the Antliarhinus Zamiæ, which inhabits the Cycas Caffra, a Cape palm, in the larva state; and which is thus described: "Larva habitat intra squamas ipsius strobili femini, ubi nutrimentum suum sumit; tam ex ipsis nucibus quam ex rubro carne, singulam obvelantem nucem. Alba est tota pilis albidis erectis, semiunguicularis; maxillæ brunneæ; caput, segmentum primum thoracis et anus supra brunnea, et segmentum penultimum macula brunnea notatum; in dorso et lateribus lineæ sex longitudinales e punctis parvis nigris; pedes *veri* sex, segmentis tribus primis inserti, *spurii* verruciformes, quorum ultimi duo parum majores, segmentis abdominalibus inserti."

The second subfamily ATTELABIDES* is distinguished by the antennæ being straight (*fig.* 41. 2.), and inserted upon the rostrum, and with

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* BIBLIOGR. REFER. TO THE ATTELABIDES.

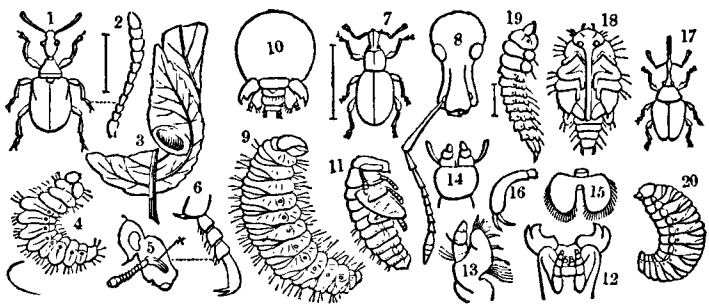
Illiger, in Schneider's Mag. v.
Thunberg. Dissert. Nov. Ins. Spec. III.
Germar, in Neue Ann. der Wetter. Gesellsch. i., and Ins. Sp. Nov.
Bohemann, in Act. Mosq. vi.

three or four terminal joints united into a mass; and the third joint of the tarsi is bifid. These insects are generally of small size, but often gaily coloured. They feed upon the leaves and tender parts of vegetables.

In the summer of 1837, M. V. Audouin directed my attention to the economy of the Attelabus curculionides in the woods near Sevres: the female of which rolls up portions of the leaves of the oak into small masses, of the size and shape of a small thimble, depositing her eggs therein. M. Goureau has published a short notice on this insect in the *Revue Entomol.*, vol. iii. (Nos. 13, and 14.) Panzer likewise states of Apoderus coryli, "Habitat in foliis coryli avellanæ, quæ in *cylindrum volvit*, et utrinque claudit." (*Faun. Ins. Germ.* 100. 8.)

The accompanying figures of the larva (*fig.* 41. 4.) of Apoderus coryli (*fig.* 41. 1.) and its nest (*fig.* 41. 3.), are copied from Dr.

Fig. 41.



Ratzeburg's *Forst-Insecten* (vol. i. p. 97. tab. 4. f. 5.). The larva is remarkable for the large erect tubercles with which the segments of the body (except those of the thorax) are dorsally furnished. In its general structure it agrees with the larva of other Rhyncophorous insects, as does also the pupa.

Thunberg. Nov. Act. Upsal, vii.
Illiger. Mag. der Entomol. vol. vi.
Hummel. Ess. Ent. III.
Kirby, in Linn. Trans. xii.
Chevrolat, in Ann. Soc. Ent. France, vol. i. (Oxycorynus.)
Hope, in Trans. Zool. Soc. vol. i. (Isacantha.)
Boisduval, in Voy. Astrolabe.
Guérin, in Voy. Coquille. — Ditto, Icon. R. An.

These insects sometimes commit much mischief, especially when they happen to occur in great quantities: this is occasionally the case with the beautiful (but in this country very rare) Rhynchites Bacchus, which sometimes abounds to so great an extent in the vineyards on the Continent, where it is called La bèche, Lisette, &c., that the local authorities are occasionally compelled to issue orders for their destruction by the inhabitants, under fixed penalties. The perfect insect attacks the young buds and leaves, the juices of which it extracts with its rostrum, causing the leaf to roll up; and subsequently depositing its eggs in the retreat thus formed, which it previously lines with silk, so that a place of safety, as well as an ample supply of food, is provided for the larva as soon as it is disclosed: the vines are sometimes entirely defoliated in consequence of these attacks. The same insect is also stated to bore into the stone of the cherry, &c., while young and soft, depositing an egg in the centre. Mr. Marsham once found it in profusion upon the Prunus spinosus at Dartford. According to M. Kollar, however, R. Bacchus, in Austria, appears to be more generally destructive to the young and tender fruit of the apple, whilst R. cupreus attacks the young fruit of plum and some other trees, and R. alliariæ the young shoots and grafts of various fruit trees. (*Naturg. der Schadl. Insecten.* Wien, 1837.)

The Rhynchites Betulæ also appears (from a notice in the *Bull. des. Sc. Nat.*, February, 1826) to be injurious to the vine. See also Baron Walckenaer's interesting memoir on the insects which attack the vine (*Ann. Soc. Ent. Franc.*, 1836, p. 242.), and a memoir entitled *Des Insectes essentiellement nuisibles à la Vigne*, upon the larvæ of Rhynchites in the *Observations sur la Physique et l'Hist. Nat. de Rozier*, July, 1771.

Several species of the extensive genus Apion (so named from the pear-shaped body) are found upon various species of clover (Trifolium), to which they do much mischief, by devouring the seed. Thus, Apion flavifemoratum attacks the purple clover, and A. flavipes the Dutch, or white, clover. (See the memoirs of Messrs. Markwick, Marsham, and Lehmann, in the sixth volume of the *Linnæan Transactions.*) I have found another common indigenous species, A. radiolum (which ordinarily inhabits the Malva sylvestris), undergoing its transformations in considerable numbers in the stems of the hollyhock, and arriving at the perfect state in the month of October. De Geer has given the history of a weevil, which appears to belong

to this genus, under the name of the Charançon de la Vesse (*Mém.*, tom. v. t. 6. fig. 31—36.) The minute weevils comprising this genus have formed the subject of several valuable monographs by Kirby (*Linn. Trans.* vols. ix. and x.) and Germar (*Mag. der Entomol.* vol. ii. and iii.). Gyllenhall and Stephens have also devoted much attention to them.

Magdalis and some allied genera, placed in the same section as the Attelabidæ by Mr. Stephens, and having the antennæ not elbowed, differ in having the scrobes, or lateral canals of the rostrum: they appear to me to be much nearer allied to the Scolytidæ than to the Attelabidæ.

The third family, CURCULIONIDÆ* *Leach* (after the removal of the Attelabidæ), nearly corresponds with the Linnæan genus Curculio,

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* BIBLIOGR. REFER. TO THE CURCULIONIDÆ.

Schönherr. Genera et Species Curculionidum, tom. iv. in 8 parts. Paris, 1833–37. — Curculionidum dispositio Methodica. Lipsiæ, 1826. 8vo.
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Bonsdorff. Hist. Nat. Curcul. Sueciæ. Upsal, 1785.
Clairville. Entomol. Helvétique, tom. i. 1798. 8vo.
Thunberg. De Brachycero, Nov. Act. Upsal, vol. vii. — Ditto, Coleopt. Rostrata Capensia, Mém. Acad. Sc. St. Petersb. tom. iv. 1813. — Ditto, de Coleopteris Rostratis, Nov. Act. Upsal, 1815.
Kyber, in Schrift. Naturf. Gesellsch. Halle. vol. vi. 1816.
Germar, in Neue Annal. der Wetterauisch. Gesellsch. vol. i. 1816. Frankfort a M. 1819. 4to. — Ditto, in his Magazin, vol. iv. 1821. — Ditto, Insectorum Species Nov. vol. i. Hal. 1824. 8vo.
Say, in Journ. Acad. Nat. Sciences. Philadelphia, vol. iii. — Descriptions of new Species of Curculionites of North America. New Harmony, July 1831. 8vo.
Sahlberg. Periculum Entomographicum. Aboæ, 1823. 8vo.
Lindenberg. Beschr. Brasilian. Russelkafers, in Der Naturfoscher, Nos. 14. and 15.
Thon. Entomol. Archiv. vol. ii. Jena, 1827. 4to.
Reich. Mantissæ Insect. fasc. 1. 1797. (Curculionidæ.)
Sparrman, in Act. Holm. 1785. (40 Curculionidæ, Cape of Good Hope.)
Herbst. Natursystem. Kafer. vol. vi.
Kirby, in Linn. Trans. vol. xii. (Century.) — Ditto, vols. ix. x. Mon. Apion.
Laporte. Sur le Genre Gasterocercus. Paris, 1825. 4to.
Dalman, in Acta Holmiæ, 1829 (Prionopus).
Guérin. Icon. R. An. Ditto, in Duperrey's Voyage de Coquille.
Chevrolat, in Ann. Soc. Ent. de France, tom. i. and ii. — Trans. Ent. Soc. London, vol. i.
Erichson. Ins. Meyer's Voyage in Nova Acta Nat. Curios. vol. xvii.

and comprises the greater number of the species of which the subsection Rhyncophora is composed. The antennæ are distinctly elbowed (*fig.* 41. 8.); the basal joint being more or less elongated, with the following joint inserted obliquely at its extremity, several of the terminal joints forming a club occasionally of a very solid construction; the legs are of a moderate length; the upper lip is obsolete; the femora often thickened in the middle, and spined beneath; the palpi are minute and conical (*fig.* 41. 13, 14.); the maxillæ flattened, and having a series of strong setæ on the internal margin; the jaws are obtusely dentate, and are placed, as well as the other parts of the mouth, at the extremity of the rostrum, or produced, part of the head (as in *fig.* 41. 12. extremity of rostrum of Hylobius abietis from beneath; 41. 13. maxilla; and 41. 14. labium of the same insect), which in some species is longer than the entire body; in others, it is short and thick (Pachyrhinus, &c.), and is often lodged, when at rest, in a pectoral groove (Cryptorhynchus, &c.); its sides are furnished, moreover, with two deeply lateral impressions, in which the basal joint of the antennæ is inserted (*fig.* 41. 5.*). Germar and Latreille have observed that, in the short rostrated species, the mentum arises in a line with the basal part of the oral orifice; but in the species with an elongated rostrum, the mentum arises from a produced horny part of the rostrum, forming a narrow footstalk, between which and the lateral margins of the oral cavity the maxillæ are affixed. The body is generally of an oval or rounded form, and narrowed in front. The third tarsal joint is generally deeply bilobed (*fig.* 41. 15.), and the fourth and fifth joints (*fig.* 41. 16.) inserted at the base of the incised part of the third joint (these figures being taken from the

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Ahrens. Monogr. Deutchs. Kohrkaferarten (Neue Schrift. Natur. Gesellsch. Halle, vol. i. 1811.
Ratzeburg. Die Forst-Insecten. Berlin, 1837.
Perty. Del. An. art. Braz.
Hope, in Trans. Soc. Ent. London, vol. i.
Zoubkof. Bullet. Soc. Imp. Nat. Mosc. tom. i. 1829.
Guérin and Percheron. Gen. des Ins. Col. pl. 13.
Boisduval, in Voyage de l'Astrolabe.
Zoubkoff, in Bull. Soc. Hist. Nat. Moscou, 1829.
Klug, in Descr. Coleopt. Madagascar.
Walton, in Ent. Mag. vol. v. p. 1. (G. Sitona, Polydrusus, Phyllobus, and Apion.)
Olivier, Stephens, Gyllenhall, Paykull, &c.

diamond beetle). The species are exceedingly numerous; the descriptions, or mere specific references, occupying the ten or twelve thick octavo volumes of the work of Schönherr, by whom, as well as by Paykull, Clairville, Germar, and others, this family has been especially investigated. There are about 400 species described by Mr. Stephens, as inhabitants of this country, belonging to the genera forming the present restricted family, few of which exceed half an inch in length, and even the tropical species are seldom more than an inch and a half long. Many of these insects are exceedingly splendid in their colours; the various species of diamond beetles surpassing the majority of Coleopterous insects. In our own country, the Polydrusi and Phyllobii are not less beautiful, although of a much smaller size. In these species the splendour is caused by minute scales, similar to those upon the wings of butterflies. There are two memoirs upon the structure of these scales in the 10th and 14th parts of the *Naturforscher* by M. Lindenburg.

These insects are entirely herbivorous, some feeding upon leaves, others upon seeds, and some upon the stems of vegetables, occasionally as in the case of the corn weevil (Calandra granaria), doing very great mischief to grain, &c.: they creep but slowly, the structure of their cushioned tarsi indicating strong adhesive, rather than cursorial, powers. On the approach of danger, they fall to the ground, or suddenly take wing; many species, however, are destitute of organs of flight, the elytra being soldered together.

The larvæ of the Curculionidæ are fleshy grubs, entirely destitute of articulated legs, but having their place supplied by a double series of retractile fleshy tubercles; the extremity of the body is not furnished with spinose processes; the head alone being scaly. The best known of these larvæ is that of Balaninus Nucum, the white fleshy grub so common in ripe nuts, in which, whilst in a very young and tender state, the egg is deposited by the parent weevil; the long rostrum being stated by some authors to be first employed in drilling a hole for the reception of the egg; the larva, when hatched, feeds upon the kernel, having the instinct not to touch the vital parts of the fruit till the rest is consumed. The larva is thick, and of a white colour, with large fleshy tubercles along the sides of the body. When full grown, it bores a hole through the shell of the nut, and falls to the ground, into which it immediately burrows, remaining unchanged until the beginning of the following summer, when it assumes the

pupa state, and the imago appears in the beginning of August. The imago (*fig.* 41. 17.) is of a rich brown colour, varied with fulvous pile; the rostrum being nearly as long as the body, exceeding in this respect every other British weevil. There are several very closely allied British species, one of which feeds upon the acorn. The larva of the nut weevil is figured by De Geer, vol. v. pl. 6. f. 14—16.; and its entire history is given by Rösel, vol. iii. tab. 67. Ratzeburg has published figures of Balaninus glandium, in its different states, in his *Forst-Insecten Col.* pl. 5. f. 5., from which *fig.* 41. 18., representing the pupa of that insect, is taken. (See also *Brit. Cycl. Nat. Hist.; Arboretum Britannicum*, p. 2028.; and *Penny Cyclop.* art. Balaninus). Swammerdam has described the larva of the common Bal. Nucum (*Book of Nature*, ii. p. 871.), but was unable to discover the insect to which it subsequently arrived. Bouché has also given a description of the larva in his *Naturgeschichte*, p. 199. Rösel has also given the transformation of another weevil, the larva of which is more elongated, and is represented (but evidently incorrectly) with legs and prolegs. This insect appears to be the Dorytomus fructuum. Several apparently distinct species are injurious to the apple, a small species depositing its eggs, in the autumn, in the bloom-buds, which are hatched in the following spring; the larva feeding upon the petals of the flowers, drawing the whole bunch of blossoms into a cluster by means of its webs, and thus destroying it; the larva then undergoes its changes in the earth, like the nut weevil (Salisbury *on Orchards*, p. 92.) An interesting account of the habits of the Anthonomus Pomorum, which appears to be different from Salisbury's insect, is given by an anonymous writer in the *Entomological Mag.* vol. i. p. 34. Ratzeburg has also given figures of the different states of Anthonomus Pomorum in his *Forst-Insecten Col.* t. v. fig. 8. Bouché has also described its larva and pupa (*Naturg. d. Insect.* p. 200. Mr. Knight, also, in his *Treatise upon the Apple*, mentions a beetle which commits great destruction upon the apples in Herefordshire. Lyonnet has given the history of a small weevil, which appears to be Anthonomus Pomorum, and which attacks the flowers of the pear in the larva state. It is said by M. De Haan to be the Curculio Pyri, but it is evidently not that insect. The larva has the fourth and eight following segments furnished with dorsal pointed tubercles, turned backwards, which it employs as feet, notwithstanding their dorsal position. (*Mém. Posth.* pl. 12. f. 13—19.) M. Kollar, also, in

his work upon the insects injurious to cultivators, has detailed, from the observations of M. Schmidberger, the habits of Anthonomus Pomorum (which ordinarily attacks the apple blossom, but occasionally the young fruit, when set, both of apples and pears), Anthonomus Pyri (which attacks the blossom-buds, blossoms, and leaf-buds of the pear), and Nemoicus oblongus (which feeds upon the leaves of the pear, apple, plum, apricot, and peach). In these observations there is a confirmation of the statement of previous authors, that the rostrum is employed to form a hole for the reception of the eggs. De Geer has given the history of another species (Anthonomus Ulmi), which, in the larva state, resides in the buds of the elm. (Vol. v. tab. 6.)

The larva of a minute species of Balaninus, of a black colour, clothed with greyish hairs, whose transformations I have traced, resides in the large and fleshy galls upon the leaves of willows, occasionally in company with the larvæ of Nematus intercus. Bouché has also described the larva of Balaninus salicivorus *Sch.*, which resides in the galls upon the leaves of Salix vitellina. The species of Nedyus in like manner form galls at the roots of various plants, N. contractus and assimilis having been reared by Mr. Kirby from excrescences upon Sinapis arvensis. The former species also does great damage to the turnip, by piercing a hole in the cuticle. (*Introd. to Ent.* i. p. 188.) Cleopus affinis also resides in galls upon the roots of Sinapis arvensis; Cleonus Linariæ, in galls at the roots of Antirrhinum Linariæ; and Baris cærulescens, in the stems of Reseda lutea; in their larva states. (Hammerschmidt, *Observ. Physiol. Pathol. de Plant. Gallarum Ortu.* Wien, 1832. 4to.) De Geer has given the history of a species of weevil, found upon the plantain, the larva of which is long and spindle-shaped; the dorsal segments continuous, without hairs, and with a pale lateral line. The head is small, and the tubercular prolegs very small (vol. v. tab. 7. fig. 17—21.); likewise the metamorphoses of a curious elongated and narrow species, Lixus paraplecticus; the larva of which resides in the stems of Phellandrium and Sium, and is asserted to be very injurious to horses when they happen to swallow it with their food; causing the disease called paraplegia. The larva is long and slender; the body nearly cylindric, and but slightly attenuated at each end; the dorsal segments are finely wrinkled, and the tubercular prolegs attached to the three first segments alone very

short. The pupa is elongated and cylindric, with the extremity armed with two short spines. (Vol. v. pl. 7. fig. 3—9.)

Signor Passerini has published an account of the injuries produced by the larva of Lixus 8-lineatus, which feeds upon the tree-cabbage in Italy. (See *Bull. des Sc. Nat.* February, 1831.)

The larvæ of the genus Hypera form small oval cocoons, like gauze, composed of loose threads, permitting the larvæ or pupæ to be seen through the meshes, and attached on the under sides of various leaves, &c. De Geer has given the history of one of the species, under the name of Charançon de la Patience (vol. v. tab. 7. fig. 10—16.). The larva is long and narrow, with the segments deeply incised, and slightly setose, with light lateral and dorsal lines. Lyonnet appears to have intended an insect of this genus, when describing the history of his " Scarabée à trompe, dont le ver se construit une espèce de cage, pour s'y changer en nymphe." (*Mém. Posth.* p. 123. pl. 12.)

The species of the genus Cionus inhabit the Verbascum, upon the leaves of which the larvæ feed. They are of a small size, nearly globular, and prettily marked with dark spots and lines. De Geer has figured the history of one of the species (*Mém.* tom. v. tab. 6. f. 17—24.); and Mr. Stephens has recorded the curious fact, that, in July, 1827, he captured a single example of each of the five British species in a garden at Ripley, upon the only plant of Verbascum growing there. Schäffer has figured the transformations of the C. scrophulariæ (*Abhandl.* vol. iii. pl. 9.), under the name of der Kropfkrauts russel kafer. The cocoon is formed with open meshes, like that of the Hyperæ. Bouché has described the larva of Cionus Verbasci *Sch.*, which is found, in the month of August, in the flowers and seeds of Verbascum Thapsum. (*Naturg. d. Ins.* p. 198.) Réaumur has likewise given the history of a species of this genus, the larva of which feeds upon the parenchyma of, and within, the leaves of the mullein. (*Mém.* tom. iii. pl. 2. f. 9—12.)

Count Fischer de Walldheim has figured the pupa and imago of another weevil (Curculio Pimpinellæ), the cocoon of which is similarly formed of open meshes. (*Oryctogr. du Gouvern. de Moscou*, fol. 1830.)

The Cryptorhynchus Lapathi resides, in all its states, upon willows; the larva boring into the trunk, and making holes as large as a goose-quill, from which proceeds a substance resembling sawdust. Its

history has been detailed by Mr. W. Curtis, in the first volume of the *Linnæan Trans.* (See, also, Loudon's *Arboretum Britannicum*, p. 1479.) According to Lister, this insect emits a querulous noise when alarmed. (*De Scar. Brit. App. Hist. Ins. Raii.*) This noise is produced by rubbing the base of the prothorax against the narrowed front part of the mesothorax. Some interesting observations upon its habits will also be found in Howitt's book of the Seasons.

The species of Hylobius are often very injurious in pine forests, completely destroying the young trees. Mr. W. S. MacLeay has published some observations upon their ravages in some of the fir plantations of Scotland in the *Zool. Journ.* vol. i. (See, also, *Arboretum Britannicum*, p. 2141.) Fortunately, they are of rare occurrence in this country. Dr. Ratzeburg has given an account of the injuries committed by the same insect, with figures of its different states, in his *Forst-Insecten*, col. t. 4. f. 11. He has also given similar illustrations of the following species of weevils, all of which are more or less injurious to timber trees: Thamnophilus violaceus, Otiorhynchus ater; Pissodes notatus, Piceæ, and Hercyniæ; and Brachyonyx indigena.

Dr. Heer has published a detailed description and figures of the larva and pupa of Pissodes Piceæ *Illig.*, which attacks the trunks of the Pinus Picea. In its preparatory states, it does not materially differ from the other larvæ and pupæ of this family. (*Observ. Entom.* 1836, tab. iv. B.) From an extract from a provincial periodical, communicated to me by Mr. Denson, it would appear that the splendid Australian Chrysolophus spectabilis undergoes its transformations in the heart of cedar trees, a living specimen having been cut out of a plank in this country.

Professor Peck has also published an account of the injuries caused to the cherry in America by Rhynchænus (Pissodes) Strobi, in the *Massachusetts Agricult. Repository*, Dec. 1816, and which has been republished, without the accompanying plate, in the *Zool. Journal*, vol. ii.

Some of the most destructive species of the family belong to the genus Otiorhynchus. I am indebted to the late A. H. Haworth, Esq., for an opportunity of investigating the habits and transformations of Ot. sulcatus (*fig.* 41. 7.; 41. 8. head of ditto), which annually caused him much damage, by destroying many of his out-door plants in pots. We found many of the larvæ (*fig.* 41. 9. magnified; 41. 10. its head, the mentum and labium extending beyond the ciliated labrum), in the month of December, at the roots of a species of Sedum, several being

found in each pot, at a short distance below the surface, and gnawing round the upper part of the root, leaving the lower parts, and the leaves and stems, untouched. They assume the pupa state (*fig.* 41. 11.) in the beginning of the summer, and in a few weeks arrive at the perfect state. The larva is considerably more elongated, and less tubercular, than that of the nut weevil: it is clothed with numerous short rigid hairs, and is destitute of any rudimental feet. Fuller details of the habits and structure of this larva, and its pupa and imago, are contained in a memoir which I have published in the *Gardener's Magazine*, No. 85., with supplemental notices in subsequent numbers.

Bouché has also described and (but very roughly) figured this larva and pupa (*Naturg.* p. 201. tab. 10. fig. 15—20.); stating that, in the former state, it feeds upon the roots of Saxifraga, Trollius, &c.

M. Bouché has also given a description of the larva and pupa of Gymnaetron villosulus, which, in the former state, resides in a gall formed upon the Veronica Beccabunga, a quarter of an inch long. He has also described the larva of Orchestes (Salius) scutellaris *Germ.*, which mines the leaves of Betula Alnus in May; and is furnished, at the extremity of its pointed terminal segment, with a brown point, as well as with six short legs; characters not observed in any other Curculionideous larvæ. The perfect insects are also remarkable for the faculty which they possess of leaping to a considerable distance by means of their incrassated posterior legs. Ratzeburg has given an account of the injuries committed on the elm by Orchestes Fagi, which is represented, in its various states, in his *Forst-Insecten*, col. pl. 4. f. 14., from which my *fig.* 41. 19., representing its larva, is copied. Mr. Curtis has also published some additional observations on this genus in his *British Entomology.* Swammerdam has, however, given us the history of a species of this genus (as proved by his observations upon its saltatorial powers), which resides between the cuticles of willow leaves; and as proceeding from a vermicle which was destitute of legs, and with the anterior segments of the body flat and broad; at least, if the larva which he figures (*Book of Nature*, pl. xliv. fig. 9.) be that of the weevil (Ibid. fig. 13.), which is not sufficiently certain from his remarks (page 83.).

In No. 31. of Loudon's *Magazine of Natural History* is an account of an American species of this family, which feed upon acorns from Philipsburg in America. The larva (*fig.* 41. 20.) of the rare English species Mononychus Pseudacori feeds upon the Iris Pseudacorus. I

have found the larvæ in profusion in the seeds of this plant at the back of the Isle of Wight in the month of August. The larvæ considerably resemble those of the nut weevil, being short, thick, tubercular and without hairs; and I succeeded in rearing many specimens, the imago eating its way out of the bud and pod, and evidently hybernating and depositing its eggs in the following spring like the other weevils. Mr. Curtis, however, considers it probable that some specimens remain in the larva and pupa state until that time. (*Brit. Ent.* p. 292.), which cannot, I should conceive, be the case.

The larvæ of Rhinodes Pruni have been described by several authors, as slug-like glossy grubs, found upon the leaves of the cherry and plum. If there be not some error in this statement, the habits of this genus and Magdalis (which are united together by Mr. Curtis) are very different; the species of the latter, as I have ascertained by rearing a great number of specimens, undergoing the transformations beneath the bark of dead willow trees, in which the larvæ burrow; the imago appears in June, in company with a species of Eulophides, which is evidently parasitic upon it.

In the third number of Silbermann's *Revue Entomologique* is contained an account of the destruction of the crops of rape in Germany by a minute larva, supposed to be that of a species of Ceutorhynchus.

The British species Rhinocyllus thaumaturgus (Antiodontalgicus *Illiger*) has been regarded by some writers as a specific in the toothach. Gerbi has given a long detail of its supposed efficacies in his *Storia Naturali d' un Nuov. Inset.*, 1794; and by whom it is stated, that a finger, once imbued with its juice, will retain the power of this disease for twelve months!

The species of the genus Brachycerus *Oliv.* inhabit the southern parts of Europe and Africa: they are found upon the ground in hot sandy situations, early in the spring. An anonymous writer informs us that Br. undatus feeds on the leaves of Arum arisarum in October. Br. barbarus attacks the medicinal squill, several being generally found at the heart of the leaves near the root. Br. algerus feeds on the leaves of a large lily growing in sea sand (*Ent. Mag.* vol. iii. p. 465.) Latreille informs us, in the appendix to *Cailliaud's Voyage*, that the women in Ethiopia string these insects together, and wear them round their necks as an amulet.

But the most destructive of all the Rhyncophora is the insect

more pre-eminently called the "Weevil," or Calandra granaria; an insect of minute size, not exceeding one eighth of an inch in length; but which, from attacking stored up grain, frequently commits incalculable mischief; the female depositing an egg in each grain, the mealy interior of which is entirely consumed by the larva. So much has been written upon the habits of these insects, and upon the most efficacious modes of destroying them, that it will be impossible to do more than refer the reader to some of the more valuable of these observations. The experiments of M. Keferstein, published in Silbermann's *Revue Entomologique*, No. 9., may especially be consulted, as well as Latreille's *Hist. Nat. &c.*, vol. xi. p. 54.; Griffith's *Animal Kingdom*, part 31.; Kirby and Spence *Introd.*, vol. i. p. 173.; *Gardener's Mag.*, vol. i. p. 444.; the *Bulletin de la Soc. Philomat.* for 1826; and the various memoirs referred to by Dryander, *Cat. Libr. Banks.* 236, 237. 544.; and likewise a memoir by W. Mills, Esq., in the first volume of the *Trans. of the Entomol. Society of London* (p. 241.)*, in which the beneficial result of the application of heat to 135° is recorded; as well as the memoir by M. Vallery on a rotatory apparatus, constructed with reference to the habits and apterous condition of the insect, and which its inventor was kind enough to exhibit and explain to me at great length at the apartments of the Institute of Paris, where a model of the machine was in action. Another species of Calandra (C. Oryzæ) attacks the rice and Indian wheat in a similar manner; whilst two other species, whose history has been traced and figured by the late Rev. L. Guilding (in a memoir which gained the gold Ceres medal of the Society of Arts, and which has been published in the *Trans.* of that society), are very destructive to the sugar-cane; C. Palmarum, which is nearly two inches long, attacking plants lately stuck in the ground, with such effect, that a fresh planting frequently becomes necessary; and C. sacchari *Guild.*, which confines itself to leaves already slightly injured. The former of these species is equally injurious to the palms of South America; its larva, which is called Grugru, being eaten with great relish by the natives when properly cooked. The larva are large, curved, fleshy grubs, destitute of legs, which enclose themselves in a cocoon, formed of strings of the stem of the plant upon

* In the *Literary Gazette*, July 1. 1825, an account is given of the destruction of weevils by means of sheep-skins with the fleece on, placed near the corn, which first attracts, and then destroys, the insects.

which they feed, neatly twisted in various directions. The larva of C. Palmarum is also figured by Herbst (vol. ii.), and by other authors. The habits of another species, which feed upon the tamarind, have been detailed by Mr. W. Christy in the first part of the *Transactions of the Ent. Soc.* Dr. Burmeister has also published a valuable anatomical memoir upon the genus Calandra, describing a new species from Southern Africa, in all its states, accompanied by some general observations upon the natural history and other peculiarities of the genus. The larva of this new species (C. Sommeri) is very thick and fleshy, and is remarkable for having the extremity of the body terminated by two points. (*Zur Naturgeschichte der G. Calandra, &c.* Berlin, 1837.) I have also noticed the same circumstance in a larva of this genus in the collection of the College of Surgeons; but the points are more obtuse. The extremity of the body of the larva of C. granaria is obtuse.

The insects of this family, in its restricted sense, characterised by the geniculation of the antennæ, are divided by Fabricius, Latreille, and Schönherr, into two groups, according to the length or shortness of the rostrum, and the position of the antennæ. In the first group (Brevirostres *Latr.*, Brachyrhynchi *Sch.*, Curculio *Fabric.*) the rostrum is short and thick, and the antennæ are inserted near its extremity (*fig.* 41. 8.). This group comprises the two primary genera or subfamilies, Brachycerus (*fig.* 41. 5. head of Brachycerus sidewise; 41. 6. tarsus) and Curculio, divided into very numerous subgenera. In the second group (Longirostres *Latr.*, Mecorhynchi *Sch.*, Rhynchænus *Fabr.*) the rostrum is generally long (*fig.* 41. 17.) and curved, and the antennæ inserted near the middle, or at the base. Three primary genera, or rather subfamilies, Lixus, Rhynchænus, and Calandra, divisible into a great number of subgenera, compose this group.*

In this tribe of insects, as elsewhere, from the multiplicity of named groups into which the old Linnæan genus has been separated, without the adoption of any principle regulating the retention of the old generic name, it has been entirely sunk, so that we find no modern genus Curculio. Mr. Kirby, however, considers that "the only group entitled to be distinguished by that ancient name is the

* Schönherr has, however, made some observations, in the preface to his great work upon the progression of affinity in these insects, which he considers to be not only in a direct line, but also laterally radiating.

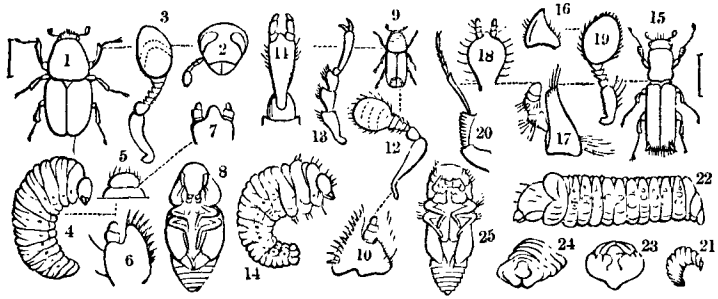
Curculio of Pliny and the Romans, called by us the weevil, and by the French, Calendre; which Clairville, Latinising the word, has made Calendra (written in his plate Calandra, which Fabricius has adopted). — Kirby, *Faun. Bor. Amer.* p. 198.

In the tabular distribution of the British genera given by Mr. Stephens (*Illustr. Brit. Ent. Mand.* vol. iv. p. 3.), the family Curculionidæ, as above restricted, comprises the whole of section A., and some of the genera of section B. (p. 5.), in which the antennæ are decidedly geniculated (Magdalis, &c.). The genera commencing with Rhyncolus, and terminating with Baris, as well as Chlorophanus, Panus, Rhinocyllus, Rhinodes, and Magdalis, belong to the section Brachyrhynchi; whilst those commencing with Ellescus, and terminating with Otiorhynchus, belong to the Mecorhynchi; which latter section I have placed after the Brachyrhynchi, in order to bring Calandra, &c., into conjunction with Scolytus, &c. The arrangement of the British genera given in my Synopsis is therefore founded upon the most recent classification of Schönherr. It must, however, be borne in mind that, from the great number of exotic types of form, an idea of the natural arrangement of the family cannot be obtained from a British collection; and that of several of the divisions there is no indigenous species.

As may be expected from the great extent of this family, the modifications of structure amongst the exotic genera are almost endless; the form of the body in some being quite linear and attenuated, in others globose or oval; while the surface is, in some, smooth and polished, in others completely covered with tubercles, and in others squamose; the legs, again, in some, are disproportionably long, especially the anterior pair, and in others the prosternum is armed with one or two long porrected spines. An interesting variation occurs in the structure of the Continental genus Dryopthorus, the tarsi being distinctly 5-jointed; the third joint not greatly enlarged, and not bilobed, and the fourth joint as large as the second.

There still remains to be noticed a small group of Xylophagous insects, very intimately allied to such wood-boring Curculionidæ as Cossonus, Baris, &c., from which, however, in deference to the views of previous authors, I have provisionally retained them as a distinct family, under

Fig. 42.



the name of Scolytidæ.* (*Fig.* 42. 1. Scolytus destructor). The head (*fig.* 42. 2.) is produced into a short rostrum; the upper lip is obsolete; the maxillæ very thin, broad, and spined at the internal margin; the maxillary palpi minute and conical; the extremity of the tibiæ hooked, with the third tarsal joint bilobed. The body is oblong or cylindric, convex and rounded above, with the head globular, and deeply immersed in the thoracic cavity; and the antennæ (*fig.* 42. 3.) have the basal joint elongated, and the terminal joints form a more or less solid oval mass. In the typical genus Scolytus, the body is suddenly and obliquely truncated at the extremity; and in some species (S. multistriatus *Marsh.*, armatus *Chevr.*, &c.) the second abdominal segment is armed beneath with a flat horizontal tooth. This appears, however, to be a sexual character. (See Ratzeburg's *Forst-Ins.* pl. 10.)

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* Bibliogr. Refer. to the Scolytidæ.

Erichson, in Wiegmann, Archiv. fur Naturg. vol. ii. 1836. 8vo. (An abstract of this memoir is published in the "Naturalist," December, 1836.)

Ratzeburg, in Nova Acta Nat. Cur. vol. xvii. — Ditto, Die Forst-Insecten. 4to. Berlin, 1837.

Guérin. Icon. R. An. Ins. pl. 40.

Dalman, in Act. Holm. 1825.

Bosc, in Journ. d'Hist. Nat. tom. ii. (Bostr. furcatus.)

Westwood, in Trans. Ent. Soc. London, vol. i. (Hypothenemus.)

Dallinger. Vollstand. Geschichte des Borkenkafers. 8vo. Weissenburg, 1798.

Von Hagen. Uber die Vermeistungen der Borkenkafers, &c. 8vo. Götting. 1805.

Krutzsch. Gebt die Borkenkafer, &c. 8vo. Dresden, 1825.

Von Begg. Der Borkenkafer in Gallizien (Lieb. aufm. Forst-m. 2 band. Prag. 1827.

The perfect insects are of small size, and of obscure colours; but they are, nevertheless, amongst the most destructive of the insect tribes: of these, the Scolytus destructor is the most obnoxious in this country, annually destroying a great number of elm trees in the neighbourhood of London; and the injury is gradually spreading into the provinces, owing to the inattention or ignorance of those whose duty it is, or ought to be, to adopt decided measures for stopping the mischief. The parks and public gardens and walks around London have been especially subject to the attacks of these insects. It has, indeed, been a question whether the insects were the *primary* cause of the mischief, or whether the trees were not previously infected in some way or other, and thus rendered an agreeable nidus for the insect. From the recent observations of Messrs. Audouin and Spence, it, however, appears evident that, in the first instance, both the male and female insects attack the trees for the purpose of obtaining food, burrowing into the trunk. This brings the trees into a state of ill health, which is adapted for the reception of the eggs and food of the larva. The female insect then burrows deeper into the trunk, and there deposits her eggs; and the larvæ (*fig.* 42. 4.), when hatched, form cylindrical galleries, diverging at right angles from the track of the parent, and parallel to each other; within which they also become pupæ (*fig.* 42. 8.); and so great is the fecundity of these insects, that their countless numbers are soon sufficient to destroy the largest tree. I must refer the reader to papers upon this subject by Mr. MacLeay, in the *Edinburgh Philosoph. Journ.* July, 1824, p. 123.; Curtis, *Brit. Ent.* art. 43.; to numerous articles in the 1st, 2d, and 3d vols. of the *Gardener's Magazine;* the 18th number of the *Magazine of Nat. Hist.;* Tilloch's *Phil. Mag.* October, 1823.; *Time's*

Brehm. Uber der Borkenkafer; Isis, 1829.

Theirsch. Die Forstkafer, &c. 4to. Stuttgard, 1830.

Gmelin. Abhandl. über die Wurmtrokniss. 8vo. Leipz. 1787. 3 col. pl. d. Ditto, Anhang. &c. (supplement to ditto), 8vo. Leipz. 1787.

Hammer. Notice sur le Typographe, in Journ. Soc. Sc. Agric. &c. Bas Rhin. No. 3. 1826.

Panzer, in Der Naturforscher, 25 st. 1791. (Several minute Tomici.)

Haas. Beobachtungen über den rinden oder Borkenkafer. Erlang. 8vo. 1793.

J. G. Bernstein. Antitypographus, &c. 8vo. Leipz. 1793.

And the general works of *Fabricius, Gyllenhall, Paykull, Herbst, Kirby, Stephens,* &c.

Telescope, 1829; Loudon's *Arboretum Britannicum*, art. Elm; Audouin in *Ann. Soc. Ent. de France* for 1836, App. p. xiv.—xvi.; and 1837, p. ii.; various observations by Mr. Spence in the *Journal of Proceedings of the Entomological Society*, vol. ii. pp. 13. 15. 20. 25. &c.; and a paper by myself in the *Gardener's Mag.* for August, 1838. Dr. Ratzeburg has given figures of the different species of Scolytus, and of the larva and pupa, in his *Forst-Insecten Col.* pl. 14. Another species of the same genus (S. pygmæus) is also exceedingly destructive to the oak, many thousand young trees having been destroyed by it in the Bois de Vincennes. (See *Ann. Soc. Ent. France*, 1836, pp. xvi. and xxx.; and 1837, p. iv.) Kollar has detailed the habits of Scolytus hœmorrhous, which attacks the trunks of the plum; and of Trypodendron dispar, which attacks the bark of the apple; whilst the trunk of the plum is also occasionally attacked by the Scolytus destructor. (*Naturg. der Schadl. Insect.* Wien, 1837.)

The great pine forests in Germany are, in certain seasons, very much damaged by Tomicus typographagus (*fig.* 42. 9.; 42. 10. maxilla; 42. 11. labium; 42. 12. antenna; 42. 13. tarsus), which is there called the Turc; and the injury caused by which is known under the name of the wurmtroekniss. The evil is occasionally so great, that prayers are offered up in the churches against its extension. In 1783, the number of trees destroyed in the Hartz forest alone amounted to more than a million and a half. (See Wilhelm's *Recreations of Natural History*, cited by Latreille, *Hist. Nat.* &c. tom. ii.; also Gmelin, *Abhandlung über die Wurmtroekniss.* Leipz. 1787; *Phil. Trans.* 1705; and Dudley in the 24th volume of the same *Transactions*.

Other species belonging to this family are also very injurious to pines and firs, as the Hylurgus Piniperda, upon which some interesting observations by Professor Lindley have been published in Curtis's *Brit. Ent.* art. 104. Dr. Ratzeburg has also published a very extensive series of observations upon the habits of these destructive insects in the *Entomologische Beitrage* (*Act. Acad. Natur. Curios.* vol. 17.), and more especially in his *Forst-Insecten*, in which a great number of species of Hylurgus and Tomicus, in their various states, are beautifully figured. Rossmäsler has also given the history of Tomicus typographus, chalcographus, Pinastri, Abietiperda, and Laricis; and Hylurgus Piniperda; in his *Forst Insecten.* Leipz. 1834. See, also, Loudon's *Arboretum Britannicum*, art. Pinus.

An account of a small species found in exotic seeds is given by Panzer in the *Naturforscher*, st. 25.; and I have published the description of a very minute species found burrowing in the binding of a book (*Hypothenemus eruditus*, *Trans. Ent. Soc. Lond.* vol. i.). Prof. Peck has also described two species of this genus, Scolytus Pyri and Scolytus Strobi, which destroy the young branches of the pear trees, and the leading branches of the Weymouth pine, in North America (*Massach. Agric. Journ.* January, 1817); and Dr. Heer has described a new species of Tomicus (Bostr. Cembræ *H.*), together with its larva and pupa, and which attacks the Pinus Cembra. (*Obs. Entomol.* 1836, pl. 5.)

The larvæ of Scolytus destructor (*fig.* 42. 4.) are thick, fleshy, curved, apod grubs, of a whitish colour, the back much wrinkled; armed with a scaly head and powerful horny jaws; the upper lip distinct (*fig.* 42. 5.); the maxillæ short, flat, and ciliated; the maxillary palpi very short, conical, and apparently only 2-jointed (*fig.* 42. 6.); the labial palpi smaller and conical (*fig.* 42. 7.). I have found the larvæ (in company with the pupæ and imago) in the month of August, in the bark of elm trees, and the former alone in November. I have also found Hylesinus Fraxini, in all its states, in the bark of elm trees, in the month of August; the larva resembling that of Scolytus.

The larvæ of Tomicus (*fig.* 42. 14.) and Hylurgus, according to Ratzeburg's figures, are of a form precisely similar to those of Scolytus and Hylesinus Fraxini. The pupæ in the two first-mentioned genera are, however, terminated by two spines, whereas the extremity of the body of the pupa of Scolytus is unarmed.

In the works of Latreille, this group of insects, with several other Xylophagous, Boletophagous, or Fungivorous tribes, is employed to effect the transition between the Curculionidæ and Cerambycidæ, commencing with those which have the club of the antennæ solid, and proceeding, through those families in which the club is more loosely constructed, to the Trogositidæ and Cucujidæ, in some of the last of which the antennæ are of considerable length; the two genera Parandra and Passandra completing the passage. In other and more important points of view, however, this mode of transition cannot be naturally maintained; the structure of the imago in many of Latreille's Xylophaga, as well as that of their larvæ, warranting

their removal to the Necrophaga, notwithstanding the modifications in the form of the tarsi.*

By most entomologists, the Scolytidæ have been confounded with the Bostrichidæ (Apate, &c.). Latreille, however, and more recently Dr. Erichson†, have traced their limits with more precision. I have made some observations upon the analogical relation of these two groups in a memoir read before the Linnæan Society in 1837.

The genera Tomicus and Platypus, it is true, disagree in some material respects from the typical characters of the family, although the solid club of the antennæ, the shortness of the maxillary palpi, and obsolete upper lip, are eminently characteristic of the present family. Platypus is a very anomalous genus, evidently forming the passage to some other group (*fig.* 42. 15. Platypus cylindrus; 42. 16. mandible; 42. 17. maxilla; 42. 18. labium; 42. 19. antenna; 42. 20. fore leg of ditto).

Dr. Ratzeburg has been so fortunate as to observe the transformations of Platypus cylindrus. It inhabits the oak, and its larva (*fig.* 42. 21. natural size; 42. 22. ditto magnified; 42. 23. head of ditto; 42. 24. extremity of its body), as might be presumed, materially differs from the other larvæ of this family. Its head is large, its body short and straight, not being curved towards the extremity, where it is somewhat obliquely truncate; the sides of the body are furnished with several rows of tubercles; the pupa (*fig.* 42. 25.) is elongated, with the intermediate coxæ very large.

The insects of this family appear to be subject to the attacks of numerous parasites; M. L. Dufour having detected great numbers of minute Ascarides in the entrails of Tomicus typographus, as well as numbers of small mites on its external surface; and Mr. Spence

* Mr. Kirby (who does not appear to be aware of the great variation existing between the Bostrichidæ and Scolytidæ) has proposed the establishment of a section under the name Xylotrypa, for the reception of Anobium, Bostrichus, Cis, Apate, Scolytus, and other wood-feeding beetles, which, with Phrenapates and Sinodendron are supposed to form a passage between the Lucanidæ and the weevils.

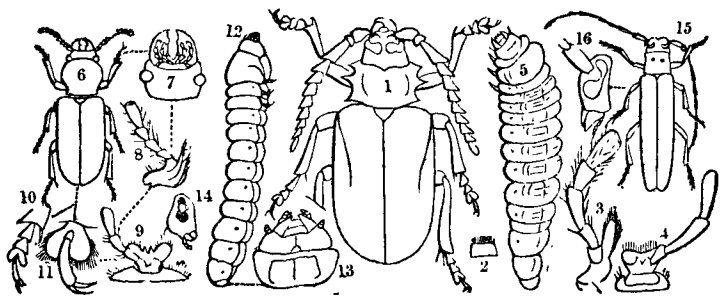
† Dr. Erichson employs the term Bostrichidæ for the family, calling Latreille's genus Tomicus Bostrichus. Geoffroy, however, who proposed the latter name, gave the Dermestes capucinus *Linn.* as the type. Latreille's nomenclature ought, therefore, to be adopted. Mr. Kirby has expressed a similar opinion.

has also observed the larvæ and pupæ of Scolytus destructor to be infested to a great extent with minute worm-like Oxyurides.

Amongst the exotic species are to be noticed, the Phloiotribus Oleæ, found upon the olives in the south of Europe, and in which each joint of the funiculus of the antennæ is furnished, in the males, with a long bristle; as well as a remarkable Brazilian Platypus, described by S. S. Saunders, Esq., in the *Trans. Ent. Soc. Lond.* vol. i., in which the basal joint of the antennæ is furnished with a long corneous process, pilose at the extremity, which gives the insect the appearance of having four antennæ.

The second subsection, LONGICORNES or CAPRICORNES *Latreille* (or EUCERATA *Westw.*), comprises a very numerous assemblage of the largest and most splendid Coleopterous insects, and which are readily distinguished, as their name implies, by the great length of their antennæ, which are seldom much shorter, and occasionally several times longer, than the entire body. These organs are generally filiform or setaceous, and simple in both sexes. In a few exotic species they are, however, flabellate or pectinate in the males, or ornamented with brushes of hair. The eyes are often emarginate or reniform (*fig.* 43. 14. 16.), and sometimes completely divided into

Fig. 43.



two portions, as in Tetraopes (*fig.* 43. 14.); the body elongate, and more or less depressed, with the elytra broader than the thorax, which is trapeziform, or narrowed in front; the head is short (*fig.* 43. 14. 16.), not rostrated, and armed with large and powerful jaws; the legs are long, with the thighs often clavate; the tarsi (*fig.* 43.

10.) have the three basal joints cushioned beneath, the first and second being dilated, the third deeply bilobed, the fourth small and nodose, and inserted between the lobes of the third, and the fifth long and slender (*fig.* 43. 11.); the mentum is short and transverse, and the labium generally membranous and cordate (*fig.* 43. 4. 9., and 44. 2. 13.); the palpi are filiform, and of moderate length.

These insects are found in woods and hedges, in the neighbourhood of timber-yards, and upon the bark of trees, beneath which the females deposit their eggs by means of a strong, corneous, and tubular ovipositor, capable of being protruded to a considerable length. Some of the species are, indeed, occasionally found upon flowers (as Molorchus and the Lepturidæ); but it is evident that their habits in their early states are similar to those of the remainder of the subsection; Molorchus possessing an elongated ovipositor, and the Lepturidæ certainly undergoing their transformations in wood, as subsequently detailed.

When alarmed, many of the species produce a slight but acute sound by the friction of the narrowed anterior part of the mesothorax, or rather a polished part of the scutellum, against the edge of the prothoracic cavity, by which motion the head is alternately elevated and depressed. It has been generally stated, that it was by the friction of the hind margin of the thorax against the base of the elytra that this sound was produced, but this is not the case.

The females are, in general, distinguished by their larger size, their shorter antennæ, and their more robust and shorter bodies. During the day, the majority of these insects are to be found upon the trunks of trees, but in the evening they take flight in search of their mates. But few observations have been made on the habits of these insects in the perfect state. W. W. Saunders, Esq., has, however, published an interesting notice upon the East Indian Lamia rubus, in the *Trans. Entom. Society of London*, vol. i., stating that it feeds upon the buds of the Pipal tree (Ficus religiosa), leaving the leaves untouched. Professor Peck, the Rev. L. Guilding, and M. Lacordaire have also respectively made observations upon various other species, as subsequently noticed.

M. Pictet has recently published a detailed account of the peculiar respiratory apparatus of some of the Longicornes, consisting of a sac emitting numerous filaments at the orifice of the spiracles (*Mém. Soc. d'Hist. Nat. de Genève*, tom. vii.). M. L. Dufour has also noticed the

remarkable peculiarity of the respiratory organs of Prionus, &c. (*Anat. Coléopt.* p. 217. t. 21. bis. f. 1.)

The larvæ reside in the interior of trees, or beneath the bark: they are provided with six scaly articulated legs, but so minute as to be completely unfitted for locomotion, their movements being performed by the assistance of a number of fleshy tubercles along the body, capable of protrusion, and which are pressed against the sides of their retreats, the segments of the body being by degrees thrust forward; the body is soft and fleshy, of a dirty white colour, having the anterior segments broadest, with the head of moderate size, flat, broad, scaly, and provided with strong horny jaws; a pair of fleshy maxillæ, and labium not porrected, and very short conical palpi; the antennæ are very minute, and 4-jointed, the joints being retractile within each other; and there are three or more ocular tubercles on each side behind the antennæ. From the habit of these insects in burrowing into the very heart of solid timber, there can be no doubt that the marvellous accounts which we constantly meet with in the journals of the discovery of insects, in cutting up logs of wood (especially foreign timber), relate to the larvæ, or perfect states, of these insects; and it is owing to the same circumstance that our English catalogues have been swelled by the introduction of numerous species, which have, indeed, been captured alive in this country, but which have no legitimate claim to be regarded as natives, having been evidently produced from larvæ imported in timber from abroad. Such, for instance, is the Lamia dentator *Fabr.*, described and figured by the late A. H. Haworth in the *Trans. of the Old Entomol. Soc. of London*, vol. i. Indeed, the late Mr. Beck, who held a situation in the London Docks, made a very extensive and beautiful collection of these exotic species, captured alive.

From the large size of many of these larvæ, and the long period during which they remain in that state, it may easily be conceived that they do much damage to trees, boring very deeply, and cutting channels into them. A few species appear to subsist in the larva state upon the roots of plants. Another peculiarity resulting from their lignivorous habits is exhibited in their geographical distribution; the tropical and thickly wooded districts of South America possessing a far greater number of species (and these, too, of the largest size) than are to be found in corresponding latitudes in Africa; the speedy decay of vegetable matter requiring

the presence of great quantities of such insects. In India but very few gigantic species of Longicornes are to be found.

This subsection is very intimately allied on the one hand to the Chrysomelidæ, by means of the genera Leptura, Donacia, and Crioceris; but the opposite transition from the Longicornes to the Rhyncophora requires many yet unknown links.

The genus Parandra* has, indeed, been employed to establish a passage between Prionus and Cucujus; but it appears to form a much more evident step between the Prionidæ and Lucanidæ; a relationship which I have discussed at some length in the 18th and 19th numbers of the *Zoological Journal*, and 26th number of the *Magazine of Natural History*.

In the Linnæan system, these insects formed the three genera, Cerambyx, Leptura, and Necydalis. Geoffroy, Fabricius, and other naturalists, endeavoured to render these groups more natural, by the transposition of various species, or by the establishment of other generic groups, amongst which may be particularly mentioned Parandra *Latr.*, Spondylis † *Fabr.*, Prionus *Geoffr.*, Lamia *Fabr.*, and Saperda *Fabr.* The immense number of species discovered since the days of Linnæus, have rendered the investigation and classification of these insects very difficult. The labours of Messrs. Saint Fargeau and Serville, in the *Encyclopédie Méthodique*, and more especially the revision of the subsection by the last-named author in the *Annales de la Société Entomologique de France*, have contributed greatly to an advantageous classification of these insects. It is evident that there are several principal types, to which the whole of the species may be referred; and hence the families PRIONIDÆ, CERAMBYCIDÆ, and LEPTURIDÆ have been proposed. Latreille has, indeed, in the second edition of the *Règne Animal*, proposed only two primary divisions, characterised by the structure of the eyes; the first, with emarginate eyes, being divided into three groups, Prionii, Cerambycini (including Cerambyx, Clytus, Necydalis, &c.), and Lamiariæ (including Lamia

* The type of this long-established genus is the Attelabus glaber *De Geer*, iv. t. xix. f. 14., of which Mr. Kirby, in his observations on the affinities of these insects, speaks as an overlooked insect, and which he proposes to name generally Gnathophorus. (*Faun. Bor. Amer.* p. 166.)

† Mr. Kirby considers that the genus Spondylis, though placed by Latreille amongst the Prionidæ, seems to furnish a link connecting the Platysoma with another family of Capricorns, the Lamiadans, and particularly with L. vermicularis *Donov.*

and Saperda); and the second, having rounded eyes, being solely composed of the family Lepturidæ. M. Serville, on the other hand, has four groups of equal rank; Prionii, Cerambycini, Lamiariæ, and Lepturetæ. That the Lamiariæ constitute a distinct group, will not be doubted; but the characters which separate them from the other Cerambycidæ, namely, the vertical direction of the head, and the truncation of the palpi, can scarcely be deemed of sufficient value to raise them to the rank of a distinct family, equivalent to the Prionidæ and Lepturidæ. Moreover, the general appearance, colours, and habits of the insects appear to warrant the establishment of only three families; the Prionidæ being by far the largest insects in the subsection, of obscure colours, with large exserted jaws, and antennæ of moderate length: the Cerambycidæ are of moderate size, and gaily ornamented, with longer antennæ; whilst the Lepturidæ are generally of smaller size, the antennæ but of moderate length, and the habits more diurnal than the preceding. Mr. Stephens has, indeed, introduced the Cucujidæ into this subsection; a step which most certainly violates nature.

The first of the three families of which the subsection is composed is the PRIONIDÆ* *Leach*, comprising some of the largest known insects

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* BIBLIOGR. REFER. TO THE PRIONIDÆ.

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Olivier, Fabricius, Palisot Beauvois, Herbst, Drury, Dalman, &c.

(*fig.* 43. 1. Prionus coriarius), and distinguished by the emarginate eyes; the upper lip obsolete, or very small (*fig.* 43. 2.); the head not narrowed behind into a neck; the mandibles very large, and robust, especially in the males; the internal maxillary lobe small, or obsolete (*fig.* 43. 3.); the palpi moderately long; the labium small (*fig.* 43. 4.); the antennæ are inserted between the base of the mandibles and the eyes, but their basal insertion is not immediately surrounded by the notch of the latter; the thorax is generally transverse or square, and toothed at the sides.

The perfect insects are generally of dark and obscure colours; they are very inactive during the day, but take flight in the twilight; they are found upon the trunks of trees; and M. Lacordaire informs us (*Ann. Soc. Ent. France*, tom. i.), that the large Prionus cervicornis saws off the branches of trees with its large mandibles.

Rösel has described and figured the transformations of Prionus coriarius (*Insect. Belustig.* vol. ii., Scar terrestr. tab. 2.). The larva (*fig.* 42. 5., reduced from Rösel's figure) is a broad, flattish, white grub, with the body gradually narrowed towards the posterior extremity, and divided into a head of moderate size, thirteen segments, and an anal lobe; the first segment is short, the second large, and subdepressed; the head is capable of being considerably retracted into the first thoracic segment; the mandibles are very powerful, but small and triangular, and are employed in gnawing the wood, upon which the insect feeds; the three pairs of legs are very minute, and attached to the three thoracic segments; the seven following segments are also furnished with fleshy tubercles, which are alternately applied to the surface of the object upon which it is placed. When full fed, it forms a large cocoon, chiefly composed of chips of gnawed wood, wherein it passes its pupa state; in which it offers no other peculiarity, except that the antennæ are laid along the sides of the body, over the elytra. It is also observed that, before the larva undergoes its change to a pupa, it has the instinct to bore its hole close towards the outer surface of the tree, so that the perfect insect may the more readily effect its escape.

The species of this family are for the most part extra-European, three only being found in this country, belonging to the genera Prionus, Spondylis, and Asemum.

The structure of the genus Spondylis (*fig.* 43. 6. Spondylis buprestoides; 43. 7. under side of its head; 43. 8. maxilla; 43. 9.

labium; and 43. 10, 11. tarsi of ditto) proves that it is one of the aberrant forms of the family. I have published figures of the details of this genus in the supplemental plates of the *Zool. Journ.* tab. 47. f. 8. The Cerambyx striatus and rusticus *Linn.*, which have been generally regarded as belonging to the genus Callidium, have been formed by Eschscholtz (*Bull. Soc. Nat. Mosc.*, tom. ii.) into the genus Asemum, and placed in the present family; differing from Callidium in the structure of the eyes, and approaching Spondylis in the form of the thorax. I have further noticed, upon dissection of Cer. striatus, that the very minute lobes of the maxillæ, and the smallness of the upper lip, which are characteristics of the present family, are also found in that insect. As, however, these two species are also nearly allied to Callidium, it would, perhaps, be most natural to place Spondylis at the end of the Prionidæ, and make Asemum the connecting link with the following (Cerambycidæ), commencing the lattter with Callidium.*

Amongst the exotic genera, the Brazilian genus Parandra (which is not, however, admitted amongst the Longicornes by M. Serville) offers several important characters, differing from all the Longicornes in the very short and transverse labium, with its front margin forming the segment of a circle, and very hirsute: the body is highly polished and smooth; the antennæ short, and submoniliform. (See *Zool. Journ. Suppl.* pl. 47. fig. 7. for details.)

The Brazilian genus Anacolus *Latr.* is also remarkable in having the elytra short and triangular, not entirely covering the wings and abdomen. Mr. Say has described a North American insect, in which the wings are entirely wanting, and the elytra soldered together, under the name of Moneilema, which appears to be nearly allied to the genus recently established by M. Guérin, under the name of Prionapterus; having short elytra, and being, as the name suggests, wingless. The Prionus rostratus, in which the mandibles are very long, but incurved, and the prosternum produced into an acute deflexed spine, has been formed by Mr. Vigors into the genus Dorysthenes. Another curious Indian species, allied to the foregoing, forms the genus Dittosternus *Hope*, in which both the pro- and meso-sterna

* Since this was written, Dr. Ratzeburg has published figures of the various states of Spondylis buprestoides, the larva of which (*fig.* 43. 12.), in the large size of the head (*fig.* 43. 13.), bears a much greater resemblance to the Lepturidæ than to Prionus. (*Die Forst-Insecten*, Col. pl. xvii. f. 12.)

are produced into advanced points. A very splendid species from Mexico, with long curved mandibles, very long palpi, and spinose head and thorax, forms the genus Psalidognathus *Gray* (*Griff. Anim. Kingd.* pl. 6. and 14.). M. Bohemann has described several species of the same genus in the *Trans. of the Royal Acad. of Stockholm* for 1834. The Brazilian genus Psygmatocerus *Perty* (*Isis*, vol. xxi. No. 7.), is remarkable for the antennæ being furnished with very long, flattened, lateral plates in the males.

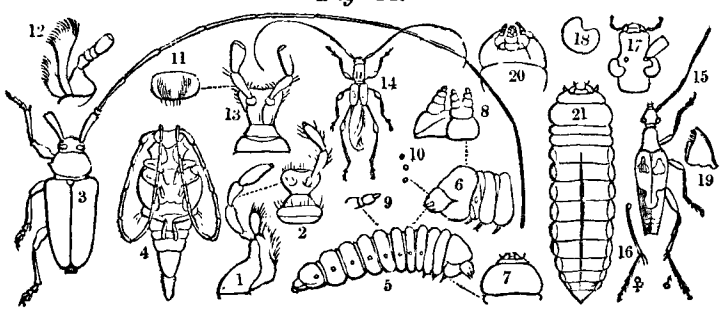
The second family, CERAMBYCIDÆ* *Leach*, comprising the Linnæan genera Necydalis and Cerambyx (except such species of the latter as constitute the preceding family) is distinguished by the exserted and transverse labrum (*fig.* 44. 11.); the reniform or lunate eyes; the antennæ very long, inserted close to the inner margin of the notch of the eyes, and never serrated; the maxillary lobes are distinct and membranaceous (*fig.* 44. 12. maxilla of Cerambyx moschatus; 44. 1. ditto of Saperda carcharias); the body is long and subdepressed, occasionally subconvex; the femora often clavate; and the tarsi short, and of the ordinary pseudotetramerous form. The maxilla, in some of

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* BIBLIOGR. REFER. TO THE CERAMBYCIDÆ.

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And the works of *Drury, Donovan, Olivier, Herbst, Palisot Beauvois, Fabricius, &c.*

Fig. 44.



these insects (Tragocerus *Trans. Ent. Soc.* vol. i. pl. 2.), exhibits a singular formation; the external lobe being very long and brush-like, the palpi very short and 4-jointed, the basal joint oblong, the three others small, and inserted obliquely at the extremity of the basal joint, forming an angle. A somewhat similar formation exists in the musk beetle (*fig.* 44. 12.).

These insects are generally of an elegant form, and beautifully variegated in their colours: they are found in forests, hedges, or woods, sitting upon the trunks of trees, or more rarely upon flowers. Some of the exotic species are remarkable for having the antennæ and legs covered with thick pencils of hairs; others are distinguished by the emission of a fragrant odour, not unlike that of attar of roses, which is so powerful, that the insects may be discovered upon trees by passers by, in consequence of the scent diffused through the air, and which is retained for a considerable period after death. Hence the generic names Callichroma and Aromia, proposed for these insects by Latreille and Serville. The Cerambyx moschatus *Linn.* (or musk beetle, as it is generally but improperly termed, the scent scarcely resembling that of this drug) is the only British species belonging to this scented group: it is more than an inch long, of a fine green colour, and is abundant upon willows in the neighbourhood of London. Mr. Dillwyn (*Memorand. Swansea Col.* p. 49.) conjectures that the females remain nearly stationary, and concealed among the leaves of the trees in which the larvæ are bred; and that the fragrance, which he believes is always much more powerful in the female, may be intended, like the light of the glowworm, as a guide for the males. M. Serville also states that the scent is more powerful at the period of coupling (*Ann. Soc. Ent. de France*, 1833, p. 560.)

The wasp beetle (Clytus arietis), another very common species, undergoes its changes in old dry palings. I once observed, in the month of June (when these insects are in full activity), a great number of dead specimens of this insect sticking in small circular holes in a dry paling, with the head exposed at the mouth of the burrow. I was unable to notice any fact which would enable us to account for this curious circumstance. There are some interesting remarks on the economy of Clytus arcuatus recorded in the *Entomol. Mag.* vol. i. p. 212., and vol. iv. p. 222. In Laporte and Gory's beautifully illustrated monograph of this genus, an imago of one of the species, with the elytra and wings not yet developed, is represented as the larva!

Linnæus notices, in his *Tour in Lapland* (vol. i. p. 233.), that Cerambyx (Monochamus) *Sutor*, is occasionally infested with a beautiful red species of lice (Acarus Coleopterorum).

The larvæ of these insects are long, soft, and fleshy grubs, of a whitish colour, with a scaly head, armed with two powerful horny jaws, and six very minute legs: each of the segments of the abdomen is dorsally provided with a broad rugose tubercle, which evidently assists the insect in progression; the terminal segment of the body is unarmed. They remain two or three years in this state, changing the skins several times; the imago appearing in a very short time after the assumption of the pupa state.

The larva of Cerambyx (Hamaticherus) Heros, which is one of the largest European species, is considered by Latreille to have been the Cossus of the ancients, by whom it was esteemed a relishing treat. The larva, which, as well as the pupa and imago, is beautifully figured by Ratzeburg (*Forst-Insecten*, pl. xvi.), resides in the oak, occasioning much injury to the timber, by boring large channels in all directions through the trunk of the tree: this is also the case with the musk beetle, the larva of which (*fig.* 44. 5.) is very injurious to young willows. This larva is of a thick form and fleshy consistence; the head small; the prothorax large and transverse; the meso- and meta-thorax very short, the former furnished with a pair of spiracles, and the three thoracic segments having three pairs of very short legs; each of the eight basal abdominal segments bears a pair of spiracles: these segments are much constricted at the articulations. *Fig.* 44. 6. represents the head and three thoracic segments of a larva, closely resembling that of the musk beetle (which I was unable to rear); *fig.* 44. 7. the head and prothorax seen from above; 44. 8. the

maxilla and labium; 44. 9. one of the antennæ, and 44. 10. the eyes on one side.

I have found the larvæ of another insect of this family under the bark of trees in Kensington Gardens, and which I have no doubt is that of Leiopus nebulosus, which is found there not unfrequently. It is of the ordinary form; but I could discover no traces of thoracic legs: the anterior segments of the body are broadest. These larvæ assumed the pupa state, in which the antennæ, which are very long, are carried along the sides of the body, extending about half the length of the abdomen, and are then recurved upon the breast and over the legs, reaching as far as the eyes. Some ants killed these individuals, so that I was not able to obtain them in the perfect state.

Gœdart has figured the different states of a curious American Lamia (No. 110.); the antennæ of which, in the imago, are much longer than the body; and in the pupa these organs are bent backwards, as in the pupa of L. nebulosus, except that, being longer, they are extended beyond the mouth; the tips passing beneath their basal part, and protruding somewhat like ears.

The various states of Lamia ædilis (*fig.* 44. 3. ♂) have been figured by Ratzeburg in his *Forst-Insecten*, pl. xvi. The larva does not naturally differ from that of Cerambyx moschatus; but in the pupa (*fig.* 44. 4. ♀) the long antennæ are curled up, as in Gœdart's figure.

M. Rodrigues observed the transformations of Saperda Asphodelis, the female of which deposits her eggs at the root of the Asphodelus luteus in the month of May, upon the pith of which plant the larva feeds until the beginning of the following spring, when it assumes the pupa state; soon after which the imago makes its appearance. In like manner, the larva of Saperda cylindrica feeds upon the pith of the nut, pear, and plum; and it is in the centre of the stems that it becomes a pupa. The larva, as figured by Rösel (*Insect. Belust.* vol. ii., Scar. terrestr. tab. 3.), has a very large, oval, flat head, armed with two strong porrected jaws, and being much broader than the other segments of the body, of which the middle segments are somewhat broader than the preceding. Bouché has described the larva and pupa of Saperda Populnea*, the former of which resides in the buds of the second or third year's wood of the Populus tremula: its head is small

* Mr. F. Smith has very recently observed that this species is parasitically attacked by a species of Megarthrus, a genus of Staphylinidæ.

and flat, and the prothorax broad, with the remaining segments gradually narrowed. There is no mention made of the thoracic legs. Gœdart has also figured the different states of a large Saperda (No. 106.), the larva of which feeds in the oak, and which has been regarded as Saperda Carcharias. It is elongated, subdepressed, and fleshy, and with the head and anterior segments broadest; it is terminated by a broad, rounded, swollen joint. It underwent its change to the pupa in November, and the imago appeared in the following January. Ratzeburg has also figured Saperda Carcharias, Populnea, and linearis in their different states. (*Forst-Insecten*, pl. xvi.) Mr. Stephens has reared the Agaphanta Cardui, from a larva found in an Aspen, near Cambridge, and which had the instinct, previously to assuming the pupa state, to gnaw its way nearly through the cork of the bottle in which it was placed, so as to secure its escape on arrival at the imago state.

The larvæ of the genus Callidium are similar to those of Aromia (the musk beetle) both in form and habits. The places where they reside may be known by the long cylindrical burrows which they form, and which are filled with excrement resembling powdered wood. It is not difficult to keep these larvæ alive in the wood in which they are found, and in which they assume the pupa state; it is very rarely, however, that they can be reared to the imago state.

Mr. Kirby has given an interesting account of the proceedings of the larva of Callid. violaceum (*Linn. Trans.*, vol. v.), which, in the larva state, feeds principally upon fir timber, upon which the bark has been suffered to remain after it has been felled; residing under the bark, mining its labyrinth-like passages in every direction, and occasioning much damage by means of its powerful jaws, which resemble a large, thick, and solid section of a cone of horn; the whole of their interior flattened surfaces applied together, so as completely to grind the food. It is described as being destitute of feet, pale, folded, somewhat hairy, convex above, and divided into thirteen segments, with the head large and convex. When full grown, it bores down obliquely into the solid wood to the depth of several inches, where it becomes a pupa. (See, also, *Arboretum Britannicum*, p. 2142.) Another species, Callid. Bajulum, is of frequent occurrence, and feeds, in the larva state, in old dry posts, rails, &c., and being very injurious to the rafters of houses, which it bores through in every direction, although coated with lead, through the covering of which the larvæ, as I am informed by Mr. Stephens, bored numerous circular holes.

The same fact has also been noticed by M. Audouin (*Ann. Soc. Ent. France*, tom. ii. lxxvi.). I am indebted to Mr. E. Blyth for a larva found by him eating the interior of deal shelves in his dwelling-house, leaving only the external surface entire: it resembles in all respects the larva of the musk beetle, except that the prothorax is rather broader: it has also six exceedingly minute legs. I have little doubt that it is the larva of a species of Callidium.

Dr. Ratzeburg has figured the transformations of Callidium luridum in his *Forst-Insecten*, pl. xvii.

The Rev. L. Guilding has detailed the natural history of a West Indian species, Lamia amputator *Fabr.*: it is found in the Mimosa groves, and is destructive to the trees, both in the larva and perfect states; the former excavating the branches with labyrinth-like passages, leaving, when full grown, the surface of the branch alone entire, within which it forms a cocoon of chips, and becomes a pupa; and the imago gnaws off the branches, biting circularly round their axis, thus stopping the course of the sap, and the branch falls upon the first wind. It also bites holes in the bark with its jaws, and then deposits its eggs, by means of its long retractile ovipositor, in the puncture thus made. (*Trans. Linn. Soc.*, vol. xiii.)

Professor Peck has also given (in the *Massachusetts Agricult. Repos. and Journ.*, republished in the *Zool. Journ.* No. 8.) the natural history of Stenocorus putator, of which the larva, when full grown, eats away the wood of the thin branches of the oak, in which it resides, in a circular direction, leaving only the bark entire, and which is broken off by the first wind, and falls to the ground with the larva. Professor Peck considered that this proceeding had for its object the obtaining of a sufficient degree of moisture for the developement of the pupa, by the small twigs being brought into contact with the moist earth.

M. Solier has published a detailed account, with figures, of the various states of Parmena pilosa, the larva of which resides in the stems of Euphorbia Characias. The larva is described as being apod, and 12-jointed, exclusive of the head, which is small; the anterior segment of the body is largest, and transverse-ovate; the remainder are transverse; the penultimate segment being broader than the preceding; the segments are provided with lateral lobes; the terminal segment has two impressions and two small brown tubercles at the tip. The pupa is also terminated by two diverging spines. (*Ann. Soc. E. France.*)

The family is divisible into two subfamilies, Cerambycides and Lamiides. In the first the head is porrected, or but slightly deflexed, and the palpi are terminated by a joint more or less dilated and truncate at the extremity (*fig.* 44. 12. 13. maxilla and labium of Aromia moschata); whilst in the second the head is vertical (*fig.* 43. 15. Saperda oculata; 43. 16. its head sidewise), and the palpi filiform, or terminated by an ovate joint, pointed at the tip (*fig.* 44. 1. 2. maxilla and labium of Saperda Carcharias). The genera Callidium and Molorchus (*fig.* 44. 14. Molorchus minor) seem also to possess characters of sufficient rank to form subfamilies.

There are about forty British species of these insects (exclusive of those imported and doubtful), constituting the genera described in my Synopsis, and which are arranged according to the distribution of M. Serville; those preceding Ædilis belonging to the Cerambycides, and the remainder to the Lamiides.

Amongst the exotic genera may especially be mentioned the Brazilian Phœnicocerus *Latreille*, having beautiful flabellate antennæ. The African G. Sternotomis *Perch.* (*Gen. des Ins. Col.* pl. 16.), is composed of several brilliant species, including Lamia pulchra, regalis, imperialis, &c. I have described a very splendid species belonging to this group in the first volume of the *Trans. Ent. Soc.*, under the name of Lamia Norrisii. Macropus *Thunberg*, has for its type the gigantic, long-legged, Brazilian Harlequin beetle (Cerambyx longimanus *Linn.*). The G. Gnoma has the thorax very long, and forming a slender neck, whence the type has received the name of Giraffa. I have figured a fine New Holland species of this rare genus in Griffith's *Animal Kingdom*. Mr. Newman has described a curious genus from New Holland (Tricheops ephippiger), which receives its generic name from the singular trifid form of the eyes. (*Ent. Mag.* No. xxii. p. 171.) The New Holland G. Enicodes of G. R. Gray, founded upon the Cerambyx Fichtelii *Schreiber* (*Linn. Trans.* vol. iii., refigured, with details, in Griffith's *Animal Kingdom*), has the head laterally produced, and the elytra much longer than the abdomen, and attenuated; and in the Brazilian genus Tapeina *Serv. and Saint Farg.* (Eurycephalus G. R. Gray in *Griff. An. Kingd.*), the head is still more prominently produced at the sides; the antennæ being inserted near the extremity of the produced portion; the elytra are short and rounded, and the insects of small size. But the smallest known species of the family is the Decarthria Stephensii *Hope* (*Trans. Ent. Soc.* vol. i.

pl. 2.), from Saint Vincent's, being only three fourths of a line in length, and remarkable for having only ten joints in the antennæ.

The third and last family, LEPTURIDÆ* *Leach*, nearly corresponding with the Linnæan genus Leptura (*fig.* 44. 15. Strangalia elongata ♂; 44. 16. posterior tibia and tarsus ♀), comprises such longicorn beetles as have the eyes rounded, or very slightly emarginate (*fig.* 44. 18.); the antennæ of moderate length, inserted before the eyes; the head is inclined downwards, and elongated behind the eyes, or narrowed into a neck (*fig.* 44. 17.) at its union with the thorax, which is conical or trapezoid, and narrower in front than the head; the mandibles are acute at the tips (*fig.* 44. 19.); the elytra are narrowed to the tips, so as to give the terminal part of the body the appearance of an elongated but reversed triangle.

The perfect insects are active, and are found upon the trunks of trees, or more commonly upon umbelliferous flowers in the hot sunshine. They are often ornamented with yellow markings upon a dark ground. They reside in their previous states in the trunks and stumps of trees. It is in such situations that I have observed the transformations of Rhagium vulgare and Strangalia elongata. The larvæ of these two insects closely resemble those of the Cerambycidæ, but are of a more uniform breadth; and the head is nearly equal in size and breadth to the following segment (*fig.* 44. 20. head and prothorax of larva of Strangalia elongata), which, as well as the head, is depressed and scaly. The posterior margin of the thorax, and the abdominal segments of the pupa, of the latter species, are furnished with transverse series of short, recurved spines; and the extremity of the abdomen is also terminated by two acute points bent upwards. Dr. Ratzeburg has figured the transformations of Rhagium indagator (*Die Forst-Insecten, Col.* t. xvii.).

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Hope, in Trans. Ent. Soc. vol. i.
Lefebvre, in Silberm. Rev. Ent. vol. iii.
And the general works of *Gyllenhall*, *Stephens*, *Olivier*, *Fabricius*, &c.

I am indebted to Mr. Ingpen for a larva (*fig.* 44. 21.) taken in rotten wood in Bewdley Forest, which varies from the Cerambycideous larvæ, in the larger size of the head, and in the abdominal segments being furnished with lateral fleshy lobes, in the terminal segment of the body being produced in an obtuse point over the anus; the body is of equal breadth throughout, and subdepressed; the jaws and upper lip are advanced. It has six very short legs, and the remaining segments unprovided with fleshy retractile prolegs. It was found in company with Mesosa nebulosa; but I have no hesitation in giving it as the larva of Rhagium inquisitor.

It appears to be a peculiarity in the geographical distribution of these insects, that none exist in India (Westermann, in *Silberm. Rev. Entomol.* No. 3.).

These insects are of moderate size, and are generally gaily coloured. There are about thirty British species belonging to the genera arranged in my Synopsis, according to the revision of M. Serville.

Amongst the exotic genera, Vesperus *Dej.*, composed of two species inhabiting the south of Europe, merits notice from the remarkable diversity exhibited by the sexes; the male being narrow and winged, and the female very broad, with the elytra small, soft, and attenuated, and the wings rudimental.

In the third subsection of the Pseudotetramera, PHYTOPHAGA* (EUPODA *Latreille*), the body is generally thick, and of an oval, suborbicular, or quadrate shape. The head is short, without any frontal porrection, and immersed as far as the eyes in the thorax; the antennæ generally much shorter than the body, and filiform, or but slightly and gradually thickened to the tips, with moniliform or conical joints (*fig.* 45. 10., 46. 7.); the parts of the mouth are short, or but little exposed; the jaws are short, corneous, trigonate, with the outer edge curved and thickened; the lower jaws are terminated by two lobes, the external one often resembling a palpus, and the internal one not being furnished with a corneous tooth at the tip; the lower lip is thick and generally quadrate; the palpi are terminated by a short ovoid, or subulated joint; the tibiæ are either unarmed, or furnished with very short spurs; in some species the hind legs are formed for leaping.

* Kirby (*Fauna Bor. Amer.* p. xxvii.); but in p. 227. the term is changed to Phyllophaga; I have preferred the former as being more correct.

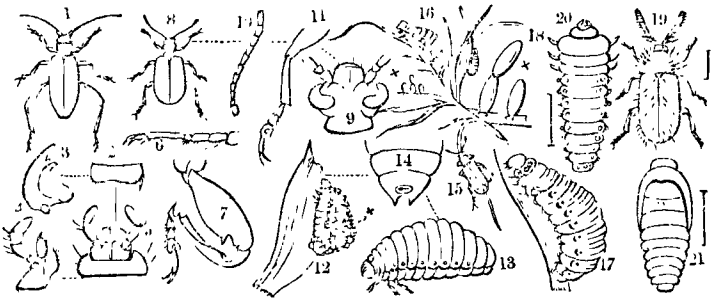
These insects are generally of small, or but moderate size, and amongst them are to be found some of the most splendid of the beetle tribes; whence, indeed, the name of the typical genus Chrysomela, or golden beetles. They are found in their larva and imago states on plants, upon the leaves and tender portions of which they feed; occasionally (as in the turnip-fly, Haltica, and asparagus beetle, Crioceris Asparagi) causing great injury to the farmer and horticulturist. The larvæ being external feeders, are furnished with legs formed for walking, and are of various colours. Some undergo their transformation to the pupa state attached to the leaves or stems of plants, whilst others descend into the ground.

In the Linnæan system these insects were comprised in the genera Cassida, Hispa, and Chrysomela, with the exception of a few placed in the genus Leptura. Latreille in his earlier works considered this subsection as forming a single family, to which he gave the name of Chrysomelinæ, and which he divided into two groups, the Criocerides and Chrysomelides, which in his later works he has regarded as respectively entitled to an equal rank with the Rhyncophora and Longicornes, under the names of Eupoda and Cyclica. As, however, the insects composing the Eupoda cannot be considered as exhibiting a type of form equally distinct with those of Curculio, Cerambyx, and Chrysomela, and as they are evidently more nearly related to Chrysomela than to Cerambyx, I have not hesitated in adopting the earlier views of Latreille, adopting the new name Phytophaga for the two groups collectively, rather than employ for them jointly the restrictive name either of Eupoda or Cyclica.

Respecting the affinities of these insects, it is to be observed that Donacia is very nearly allied to the Lepturidæ, with which, indeed, its species were associated by Linnæus and Geoffroy. The species of Crioceris are very nearly allied to Chrysomela and Cassida both in the larvæ and perfect states; indeed, there is a striking identity between some species of Crioceris and Cassida in the habits of the larvæ, as subsequently noticed. On the other hand, Chrysomela is allied to Coccinella in the structure of the larvæ, although in the aphidivorous habits of the latter, and in some other important respects, these two groups are widely apart. Mr. Kirby further regards the Phytophaga as allied to the weevils, by means of such genera as Anthribus, Chlamys, &c.

The first division of the Phytophaga, comprising the single family CRIOCERIDÆ* *Leach*, is named by Latreille EUPODA, from the enlarged size of the hind legs in some of the species; but which, in contradistinction to the other division Cyclica, may more appropriately be named PARAMECA. In these insects the body is more or less oblong (*fig.* 45. 1. Donacia crassipes; 45. 8. Crioceris merdigera),

Fig. 45.



with the head and thorax narrower than the abdomen; the antennæ are filiform, or slightly thickened towards the tips, and inserted before the eyes, which are prominent, rounded, or but slightly emarginate; the head is immersed, nearly as far as the eyes, in the thorax, which is narrow, cylindric, or transversely square. The outer lobe of the maxillæ is broad, and not palpiform; the abdomen is large, compared with the other parts of the body, and of an oblong, square, or

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* BIBLIOG. REFER. TO THE CRIOCERIDÆ.

Kunze. Entomol. Fragmente, Halle, 1818. (Donacia and Zeugophora).

Ahrens, in Nova Act. Hall. 1. 3.

Germar. Beitrage zu ein Monogr. Donacia, 8vo. Halle, 1817. *Ditto.* Nachtrag zu Ahrens Monogr. 8vo. Halle, 1817.

Hoppe. Enumer. Ins. Elytr. Erlang. Erl. 1795. (Donacia).

Klug, in Entomolog. Monographien; and in Iahrbucher der Entomol. vol. i. (Megalopus).

Mannerheim. Observations sur le Megalope, in Mém. Acad. Imp. Scienc. St. Petersb. vol. x.

Gistl. Faunus No. 2. (Monogr. Megalopus.)

Guérin. Icon. R. An. Ins. pl. 47.

Perty. Del. Animal, art. Braz.

MacLeay, in King's Voyage to Australia. (Megamerus and Carpophagus.)

Griffith. Animal Kingdom Insects. (*Ditto*, and Goniopleura, *Westwood.*)

Germar, in Silberm. Rev. Ent. No. 10. (Brachyscelis).

elongate triangular form; the posterior femora are often much incrassated. The species are generally found upon the leaves or stems of various plants, some preferring the aquatic, and others the liliaceous, tribes. The larvæ of those species which frequent the former feed upon the inner substance of their stems; whilst the latter are exposed, feeding upon the leaves, but covering themselves with a sort of mantle, formed of their own excrement.

Amongst these insects Donacia, is most nearly allied to the Lepturidæ, the larva being an internal feeder, and the organs of the mouth being not very dissimilar.

Latreille subdivides this division into two groups: SAGRIDES and CRIOCERIDES; the former having the mandibles terminated by an acute point, and the lower lip bilobed; and the latter having the mandibles truncate at the tip, with two or three acute teeth, and the lower lip entire. It will, however, be more convenient to regard them as subfamilies; the Eupoda being thus composed of a single family, CRIOCERIDÆ *Leach.*

The species of the genus Donacia (*fig.* 45. 1. Donacia crassipes, 45. 2. labrum, 45. 3. mandible, 45. 4. maxilla, and 45. 6. labium, of D. Menyanthidis) are generally of brilliant metallic tints; and many of them are clothed beneath with a fine silky down, which must be of service in protecting them from the action of the water when they happen to fall from the plants upon which they reside (as the Scrophularia, Nymphæa, &c.), and in the stems of which the larvæ take up their abode. They are naked in this state; but no precise description has been given of these larvæ, which, from the osculant character of the genus, it is very desirable should be made known. The pupæ, according to M. Ad. Brongniart, are inclosed in silken cocoons, attached to the roots, filaments, or surculi of these water-plants, on one side only, forming knots along the stems. A correspondent of the *Mag. Nat. Hist.*, No. 12., has published some observations upon certain egg-shaped transparent brown cases, found in the winter, close to the root of Arundo Phragmites, and considered as the winter quarters of Donacia micans, the perfect insect being found therein, but which were evidently the construction of the larvæ, serving as cocoons. In Mr. Kirby's collection, presented to the Entomological Society, one of these cocoons is preserved.

Reaumur (*Mémoires*, vol. iii. pl. 17. mém. 7.) has given us an interesting account of the habits of the lily beetle, Crioceris merdigera

(*fig.* 45. 8. 45. 9. head, 45. 10. antenna, 45. 11. hind leg of this insect). The eggs (eight or ten in number) are deposited upon the leaves of the white and other lilies, fastened near together by a glutinous secretion, which soon hardens. The larvæ are hatched in about fifteen days; at first, they feed gregariously upon the parenchyma of the leaf, progressing in regular rows, but separating as they increase in growth; they are short, thick, and fleshy, with six articulated legs, and the skin of a dirty colour. The larvæ (*fig.* 45. 12. and 13. magnified) are, however, generally entirely covered with a layer (*fig.* 45. 12. ×.) of humid matter, resembling macerated leaves, but which is composed of the excrement of the insect, the anal aperture being placed in the dorsal part of the last segment of the body (*fig.* 45. 14.), thus affording a singular, but apparently disgusting, means of defence against the effects of the sun, or the rapacity of insectivorous birds; the excrement being by degrees pushed forward and upwards, without adhering to the body of the larva, which is, indeed, able to cast it entirely off at will. The larva attains its full size in about a fortnight, when it descends into the earth, forms an oval cell, smoothly polished, and coated on the inside with a varnish-like secretion, within which it assumes the pupa state, which lasts about another fortnight. (See also Vallisnieri, *Esperienze ed Osservazione*, 1726, p. 195., Cantaride de Gigli.)

M. Boudier has published (*Mémoires de la Soc. Linneene de Paris*, t. iv.) an account of the habits of another species of the same genus (C. brunnea *Fab.*), which resides, as well as its larva, upon the Lilium convallaria. An abstract of this memoir is given in the *Bulletin des Sciences Naturelles*, for July, 1827.

The larvæ (*fig.* 45. 16. and 17. ditto magnified) of another beautiful species (C. asparagi, *fig.* 45. 15.) are occasionally very injurious to asparagus which has been allowed to grow up, during the summer months. Their transformations are effected in a few weeks. The eggs (*fig.* 45. 16. × and 18. ×) are oblong-oval, and placed on the plant by one of their ends, one being sometimes attached at the end of another. The larvæ are short, thick, and fleshy, with the anterior part of the body somewhat attenuated; they are much wrinkled, of an ashy colour, with the head and six scaly articulated legs, as well as two oblong spots on the first segment, black; they also possess a terminal fleshy proleg, and the underside of the abdominal segments is furnished with small tubercles, serving as legs; the sides of the abdo-

minal segments are also furnished with larger fleshy, pale-coloured tubercles, above which the spiracles are placed; the antennæ are distinct, but very minute; the larvæ are very slow in their movements, and discharge a black fluid from the mouth when alarmed. During the summer of 1836 they did much damage to the asparagus plantations along the Western Road, particularly those of the Duke of Northumberland. Bouché has given a description, accompanied by a very bad figure, of this larva, in his *Naturgeschichte*, p. 204. pl. 10. f. 38., in which he has entirely overlooked the legs. Rosel has described and figured the different states of the same insect in his *Insect. Belustig.* vol. ii. Scar. terr. cl. 3. tab. 4., as has also Frisch, in his first vol. t. 6. See also my memoir on this insect in the *Gardener's Magazine*, No. 89. Another species, C. 12-punctata, also attacks the asparagus: it is, however, exceedingly rare in this country. Frisch has figured its various states in his second vol. pl. 5. tab. 28.

Mr. Babington has published a short notice relative to the habits of the rare British species Macroplea zosteræ, of which he discovered a great number of specimens in the centre of the dense mass of leaves and branches of Potamogeton pectinatus, always beneath the surface of the water, many being found coupled. (*Ent. Mag.* No. 22. p. 438.) (*fig.* 45. 6. represents the remarkable posterior tarsus of this genus).

Many of these insects emit a noise like that made by the small Lepturæ, when alarmed; probably caused by the friction of the prothorax against the base of the mesothorax, or of the abdomen against the elytra.

Amongst the exotic genera are especially to be noticed the Brazilian genus Megalopus, the splendid Asiatic and African genus Sagra (*fig.* 45. 7. hind leg of ♂ Sagra), and the New Holland genera Carpophagus and Megamerus *MacL.*, in all of which, but more especially in Sagra, the hind femora are incrassated and toothed, and the tibiæ curved; the two last-named genera seem to form a connecting link between the Crioceridæ and the Bruchidæ, in addition to those already alluded to.

The second division of the Phytophaga is named CYCLICA by Latreille, from the rounded form of the body of the majority of these insects, in which the base of the elytra is not broader than the hind part of the thorax. The antennæ are short and filiform, or but slightly thickened at the tips; the tarsi are formed as in the Crio-

ceridæ; the outer lobe of the maxillæ is narrow, and nearly cylindric, and articulated, so as nearly to resemble a palpus; the internal lobe is larger, and without any terminal scaly hook; the lower lip is rather square or ovate, and entire in front, or but slightly emarginate.

These insects are generally of small or but moderate size, few exceeding an inch in length. They are commonly ornamented with brilliant metallic colours, with the body polished, and not provided with a coating of silken pile or hairs. In their movements they are slow and timid, falling to the earth on the approach of danger. Ordinarily, however, the structure of their tarsi enables them to retain firm hold upon leaves, &c.

All the larvæ of these insects with which we are acquainted are hexapod, with the body soft, tubercular, and varied in colour; subsisting, like the perfect insects, upon the leaves of various plants, to which they are generally affixed by a viscid matter, which they emit in such situations: the pupæ of some species may also be found having the exuviæ of the larvæ rolled up into a small mass at the extremity of the body. Other species pass the pupa state under ground.

The following variations occur in the habits of the larvæ of these insects: — 1. Those which conceal themselves beneath an excrementitious covering (Cassida); 2. Those which reside in tubes which they carry about with them (Cryptocephalus); 3. Those which are naked and exposed (Chrysomela, &c.); and 4. Those which are concealed in the interior of leaves, upon the parenchyma of which they feed (Haltica). Hence, and in conjunction with the mode of insertion of the antennæ, Latreille has divided this division into three groups, which appear to be of equal rank with the families, and are named Cassididæ, Galerucidæ, and Chrysomelidæ.

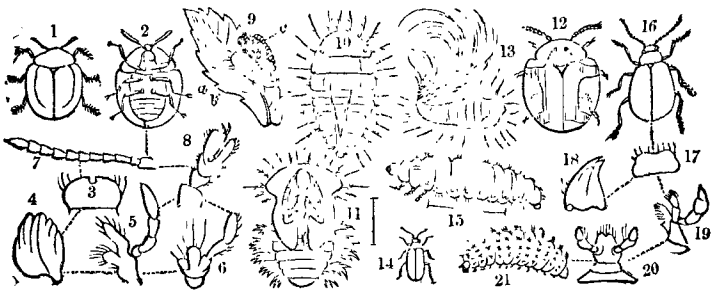
The first family, CASSIDIDÆ* (Cassidiadæ *Leach*), is distinguished by the broad, subdepressed form of the body (*fig.* 46. 1. Cassida

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* BIBLIOGR. REFER. TO THE CASSIDIDÆ.

Brahm, in Der Naturforscher, St. 29.
Schonherr. Syn. Ins. vol. iii. Appendix.
Vigors, in Zool. Journ. vol. ii.
Perty. Del An. art. Braz., and Obs. Col. Ind. Orient.

Fig. 46.



equestris, upper, 46. 2. ditto, underside); with the antennæ (*fig.* 46. 7.) inserted near together on the crown of the head, and straight, short, filiform, or nearly cylindrical, and slightly thickened towards the tips. The mouth is situated on the underside of the head, with the lower parts very weak and membranous, being defended by the prosternum when at rest; the palpi very short and filiform (*fig.* 46. 3. labrum, 46. 4. mandible, 46. 5. maxilla, and 46. 6. labium of Cassida equestris); the eyes are oval or rounded; the legs are contractile, with broad short tarsi (*fig.* 46. 8.), the third joint being very deeply bilobed, and inclosing the terminal joint between its lobes. The body is flattened beneath, so that, by the assistance of the dilated tarsi, the insects are enabled to lie close upon leaves, where they generally remain in an inactive state. They are of an orbicular or oval form, with the thorax and elytra dilated at the sides into a broad and flat margin; the head being concealed by the anterior margin of the former (*fig.* 46. 2.), or deeply immersed in its anterior emargination. The colours of these insects are very agreeably diversified, being ornamented with spots, fasciæ, &c. Some of the foreign species are of the most singular forms; some bearing a very strong analogy to the Testudinata, whence the family has received the name of Tortoise beetles. In some exotic species the centre of the suture of the elytra is elevated into a long upright horn.

Guérin. Icon. R. An.
Griffith. Animal Kingd. Ins.
Guérin and *Percheron.* Gen. des Ins. pl. 12.
Paykull, in Act. Holm. 1801.
Thunberg, in Nov. Act. Upsal, vol. viii. (3 Spec. Alurnus, Cape G. Hope).
And the works of *Fabricius, Olivier, Gyllenhall,* &c.

The larvæ of such species as have hitherto been observed form for themselves a covering of excrements, which they bear over their backs by the assistance of an elongated forked appendage arising from the extremity of the body, and bent forwards, reaching nearly to the head (*fig.* 46. 9. larva, with *c*, its covering, *a*, the place of the head, and *b*, the feet, of the natural size, *fig.* 46. 10. ditto seen from above, and magnified).

Reaumur has given a long and particular account of the habits of one of the species of Cassida (C. viridis or equestris), (vol. ii. mémoire 7. pl. 18.). The larva is broad and flattened, with the margins of the segments furnished with long and setose spines, eight arising from the prothorax, and four from each of the other thoracic segments, whilst only two arise from each of the abdominal segments; the legs are short; the extremity of the body slightly recurved, with the elongate fork arising rather above the anal aperture. By the assistance of this instrument, the excrement is by degrees collected, so as to form a parasol, which the insect has the power of elevating or depressing, or, indeed, casting entirely off, at will. It feeds on thistles and other plants, and is of an obscure green colour. The pupa (*fig.* 46. 11.) is also flat, with thin tooth-like serrated appendages arising on each side of several of the abdominal segments; the prothorax is also greatly dilated, entirely covering the head, and also furnished with setose spines. On assuming the pupa state, the insect loses the forks which sustained its parasol, although they may be observed, with the other parts of the exuviæ of the larva, still attached near the extremity of the body. In about twelve or fifteen days, the imago makes its appearance: it, as well as the pupa, is of a green colour. My figures of the larva and pupa are from nature.

These insects, from their singular habits and not uncommon occurrence, have attracted the attention of various naturalists. Gœdart first described the transformations of two species (*Die Insecten*, No. 116 and 117.); discovering, with his usual pronencss to the marvellous, a human effigy, surmounted by an imperial crown, in the front part of the body of the pupa. De Geer has also given the history of Cassida maculata, in the fifth volume of his *Mémoires*, pl. 5. Mr. Kirby has traced the transformations of the three following species: C. murræa (var. maculata), equestris (viridis *Illig.*), and vibex (liriophora *Marsh*), in the third volume of the *Linnæan Transactions*. In the first of these species, the excrement is arranged in fine branching

filaments, which gives the insect a singular appearance. Lyonnet has figured the transformations of two species (*Mém. Posthum.* p. 118. pl. 12. fig. 1—12.), which M. de Haan considers to be C. vittata and C. murræa. Lyonnet does not, however, appear to have been acquainted with the merdigerous habits of the larvæ, although he describes the anal fork. Latreille has given an account of the transformations of a species of Cassida in the *Annales du Museum*, vol. i., as has also Frisch (vol. i. pt. 4. t. 15.). The transformations of Cassida obsoleta are described in the *Magazine of Natural History* for 1837, p. 276., by W. Gardiner, the larvæ of which feed upon the leaves of Centaurea nigra. The larvæ of some of the exotic species of Cassida (C. ampulla *Oliv.*), as well as those of the genus Imatidium, are also merdigerous, producing an assemblage of very long filaments, resembling a filamentous lichen.

The late General Hardwicke published an account of the transformations of a beautiful East Indian species of Cassida, in the sixteenth number of the *Mag. of Nat. History*. (My *fig.* 46. 12. represents the imago, and 46. 13. the larva of this species.) It was found pretty common in the botanical garden at Calcutta; the larvæ destroying the foliage of a fine convolvulus. The larva closely resembles my figure of that of C. viridis; but the lateral rays are much longer, and anal fæcifork much shorter. M. L. Dufour has observed that C. viridis is subject to the parasitic attacks of a Dipterous insect (Ocyptera Cassidæ), the larva of which is nourished within the abdominal cavity of the perfect beetle (*Anat. Coleopt.* p. 238.).

Of the habits of the remarkable genus Hispa (*fig.* 45. 19. Hispa atra) the only account hitherto published is that given by Dr. T. W. Harris, in the first volume of the *Boston Journal of Natural History*, 1835, to whom I am indebted for specimens of the insects described in his interesting memoir. "The larva of this genus has not the most distant resemblance to that of Cassida, or to any other now known among the genera with which it has been artificially associated. So far as mere form is concerned, it is related to the wood-feeding larvæ of the Capricorn beetles, particularly of the genus Callidium, whilst its habits are those of the leaf-mining caterpillars of certain moths." In this memoir the transformations of Hispa rosea, Quercifoliæ, suturalis and vittata, are minutely described. I much regret that my limits will not permit me to give a detailed abstract. The larva (*fig.* 45. 20. larva of H. quercifoliæ) has the head smaller than the following

segment; the six thoracic legs of moderate length; the body depressed, tubercled at the sides, and attenuated behind, the anterior segments being broadest: the transformations are undergone in the leaves of various plants. My *fig.* 45. 21. is a copy of the figure of the pupa of H. suturalis. Dr. Harris refers to De Geer's figures 13—20. of plate 12. vol. v., representing the larvæ of some apparently coleopterous insects, which were found mining the leaves of the alder and elm, but which died; and which, from their resemblance, both in structure and habits, to the larvæ of Hispa, he considers may possibly be those of the European species. From Dr. Harris's account, it is therefore evident that Hispa is more nearly related, in the parenchymatous-feeding habits of its larva, to the Halticæ, whilst its larva is not very greatly unlike those of several of the Chrysomelidæ.

These insects are also subject to the attacks of various parasites. Dr. Harris having described an ichneumon (I. Hispæ) which attacks the larvæ of Hispa.

In the Linnæan system, this family was composed of the genera Cassida and Hispa, which constitute the types of the two subdivisions into which the family is divided by Latreille; the first of which (Cassidides) is distinguished by the orbicular or subovoid form of the body; with the thorax semicircular, concealing the head; the antennæ gradually but slightly thickened towards the tips, and the mouth concealed beneath the prosternum. These insects are very widely distributed; but the most numerous and finest species are found in the tropical climates, both of the old and new world.

The second subdivision (Hispides) is distinguished by having the body oblong, with the head disengaged, and the thorax trapeziform; the antennæ filiform, and advanced, and the mouth not concealed by the porrected prosternum. The insects of this subdivision are for the most part exotic, one species only being found in England.*

The Brazilian genus Alurnus *Fabr.*, comprises some of the largest Phytophagous insects. They are very handsomely coloured, the typical species, A. marginatus, being a very abundant species. Some

* I have reversed the arrangement of Latreille, who places Hispa before Cassida, the latter agreeing in its habits with the Crioceridæ. Mr. Kirby forms Hispa into a separate family, Hispidæ. Its general structure is, however, too near to that of Cassida to warrant its establishment as a distinct family. Mr. Stephens places Hispa between Lycoperdina and Sarrotrium, with neither of which it appears to me to possess the slightest affinity.

exotic species of Hispa have the head produced in front into a porrected horn (H. monoceros *Oliv.*, porrecta *Gyll.*, rostrata *Kirby*); these compose the genus Cryptonychus *Gyll.* (Oxycephala *Guérin*). Another Brazilian species, forming the genus Chelobasis *Gray* (Arescus *Perty*), has the head also cornuted in front, with the basal joint of the antennæ produced on the inside into a long spine.

The second family, GALERUCIDÆ* *Stephens*, is distinguished by the ovoid, oval, or subhemispherical form of the body (*fig.* 46. 14. G. nymphææ, 46. 16. G. tanaceti, 47. 1. G. capreæ); the antennæ, which are always more than half the length of the body, of an equal thickness throughout, inserted near together at the base, and at a short distance from the mouth; the maxillary palpi are thickest in the middle, with the last two joints, resembling two cones, united together at the bases, the terminal joint being more or less conical and pointed (*fig.* 46. 17. labrum, 46. 18. mandible, 46. 19. maxilla, 46. 20. labium, of G. tanaceti). The legs are simple, and nearly of an equal size; in some, however, the posterior femora are incrassated; and these species, which are the smallest in the family, possess in a remarkable degree the power of leaping.

The species are generally of small size, and of obscure colours, compared with the Chrysomelidæ, although many of the saltatorial

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* BIBLIOGR. REFER. TO THE GALERUCIDÆ.

Illiger. Mag. der Entomologie, vol. vi. (descriptions of 170 species of Haltica) Entomolog. Hefte. Frankf. 1803. 8vo. second part (descriptions of 50 Halticæ, with figures).

Kuhn, in Der Naturforscher, St. vi.

Weber. Observationes Entomol. (Oides, Adorium *Fabr.*).

Germar. Nov. Sp. Ins.

Drapiez. Annales des Scienc. Physiq. Bruxelles, iii. p. 181. (Octogonotes).

Thunberg, in Act. Ups. iv.

Thunberg, in Act. Holm. 1814. (Thaumacera).

Hope, in Zool. Misc. Gray (Œgelocerus).

Guérin. Icon. R. An. Ins. pl. 49.

Germar, in Silberm, Rev. Ent. No. 7. (Chirodica).

Perty. Delect. An. art. Braz.

Sahlberg. Periculi Entomol., and in Thon's Archiv. vol. ii.

Gyllenhall, Paykull, Fabricius, Stephens, &c.

species are ornamented with brilliant metallic tints. They are entirely herbivorous, feeding, in the larva state, either upon or within the leaves of various plants.

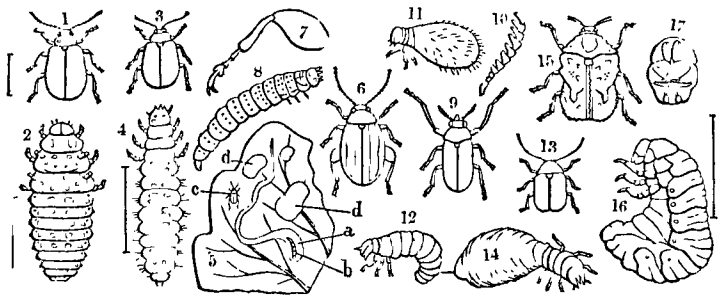
De Geer has observed the transformations of two of the species of the typical genus Galeruca, namely G. tanaceti *Linn.* (*fig.* 46. 16—21.) and G. nymphææ *Linn.* (*fig.* 46. 14, 15.). The former is found upon the wild tansy, and the latter upon the leaves of the water-lily and other aquatic plants. The larva (*fig.* 46. 21.) of the former is a black fleshy grub, cylindric, but attenuated at each end, each segment of the body being furnished with several elevated and setose tubercles, placed transversely. It is found in June; it walks very slowly, and falls from the leaf upon being disturbed, rolling itself into a circle. It assumes the pupa state in June, having the body curved; and the beetle appears in about three weeks.* (De Geer, *Mém.* vol. v. pl. 8. fig. 27—31., and Rosel, *Ins. Belustig.* vol. ii. class 3. t. 5.)

The larva (*fig.* 46. 15.) of G. nymphææ is more elongate, having the segments wrinkled, and with lateral tubercles only. I have reared this species from larvæ found in company upon aquatic plants in Horningsea Fen, Cambridgeshire. The pupa is attached to the leaves, upon which the larva feeds: this state lasts eight days (De Geer, *Mém.* vol. v. pl. 10. fig. 1—6.). These larvæ are very sluggish, although furnished with an anal tubercle, which is used as a seventh leg.

Bouché has described the larva of G. viburni (*Naturgesch.* p. 205.), which is found upon the Viburnum opulus in May. Another species, G. calmariensis, is exceedingly prolific; it inhabits the elm, and in certain seasons it is so abundant that it completely defoliates the trees. This was especially the case in the summer of 1837 at Sevres, near Paris, where M. Audouin directed my attention to its effects upon the elms. (See also Mr. Spence's observations on elm insects in the *Arboretum Britannicum.*) M. Audouin has observed that the eggs are arranged in two or three rows together along the ribs of the leaf, and are fixed by one end, being of an oval form.

* In June, 1833, the pasturage of Mount Jura was greatly devoured by the larvæ of this insect, which occasionally appears in vast numbers. (*Ann. Soc. Ent. de France*, 1834, p. 19.) Some observations, in illustration of the occasional appearance of this insect in great profusion, are noticed by Mr. W. W. Saunders, (*Ent. Trans.* vol. i. p. 33.); an innumerable quantity having been observed dead on the coast of Lincolnshire.

Fig. 47.



Dr. Ratzeburg (*Forst-Ins.* t. xx. f. 5c.) has also published a figure of the larva (*fig.* 47. 2.) of Galeruca capreæ (*fig.* 47. 1.) which so closely resembles the larva of Chrysomela populi that I am induced to believe that some mistake must have occurred respecting it.

De Geer has also given the history of Adimonia alni (*fig.* 47. 3.), a rare British species, which is found upon the alder. The larva is considerably more elongate than the majority of these larvæ, with the body thickest in the middle; the legs six in number, and destitute of tubercles. It goes into the earth in the middle of August, and appears in the perfect state in about three weeks. The larva, according to Bouché (*Naturg.* p. 206.), moves along like the caterpillars of the Geometridæ. Dr. Ratzeburg has also published beautiful illustrations of this insect in its different states (from which my figure 47. 4. of the larva is copied) in his *Forst-Insecten Coleopt.* t. xx. f. 6.

The genus Haltica *Illiger*, and the various groups detached therefrom, comprise a very extensive assemblage of species of minute size and of saltatorial habits, the hind legs being greatly incrassated (*fig.* 47. 6. Haltica nemorum magnified, 47. 7. hind leg). Their colours are often very brilliant; they feed upon the leaves of vegetables and herbs, especially preferring the cruciferous plants, amongst which the turnip is particularly liable to the attacks of several species (Halt. nemorum, &c.), and which are known by the name of the turnip fly, the perfect beetles devouring the leaves of the plant as soon as it has made its appearance above the ground: the injury thus committed is occasionally very great. The subject was indeed considered of such importance that the Doncaster Agricultural Association proposed it as one of the questions particularly worthy of investigation. The *Report*

of the Association was published by Ridgway in 1834, in which much practical information was given, but no facts were published upon the early history of the insect. The same subject was accordingly adopted by the Entomological Society for one of the prize essays established by that body; and a memoir by Mr. H. Le Keux, in which the history of H. nemorum is traced, has since been published in the second volume of the *Transactions* of the Society, in which it is stated that the larvæ feed in the interior of the leaves, thus confirming the observation of Latreille, that the larvæ devour the parenchyma of leaves, and undergo their transformations in this situation. My figure 47. 5. represents part of a turnip leaf; *a*, the mined part of the leaf; *b*, the larva in the widest part of the mine, seen through the semitransparent pellicle of the leaf; *c*, the beetle of the natural size; and *d*, holes made by the beetle; and figure 47. 8. represents the larva magnified, copied from Mr. Le Keux's plate. See further upon this subject the *Magazine of Natural History*, No. 8.; the *Gardener's Magazine*, vol. iii. p. 331., vol. iv. p. 36.; *Memoirs of the Manchester Natural History*, 2d series, vol. v.; Rusticus, in *Entomol. Mag.* No. 4.; and my article in the *Gardener's Magazine*, No. 84., and in *Mag. Nat. Hist.* vol. vii. p. 430., in opposition thereto; and the *Report* of the Doncaster Association above noticed. Dr. Hammerschmidt has observed the transformations of H. hemispherica, which he thus describes "Larva subcutanea, in foliis Clematidis adoratæ vivens (distentio pustuliformis), nympha in pilula ex terra formata, in quam larva planè adulta sese abscondit." (*Observ. Path. Physiol. de Plant. Gallar. ortu*, Viennæ, 1832, pl. 1.) In the spring of 1837 the vines in the neighbourhood of Montpellier were attacked to so great an extent by Haltica oleracea in the perfect state, that fears were entertained for the plants, and religious processions were instituted for the purpose of exorcising the insects (*Ann. Soc. Ent. de France*, 1837, p. 49.) In Sillimann's *American Journal*, No. 54., is contained a memoir upon Haltica chalybea (Chrysomela vitivora) which, as its name implies, attacks the vines.

There are about 120 British species of these saltatorial insects, which have been distributed by Latreille and Stephens into various genera. South America also possesses a very great number of species of larger size than the European ones.

The third, and last, family, CHRYSOMELIDÆ* *Leach*, is distinguished by having the antennæ inserted widely apart at the base before the eyes, or near their inner extremity. The body is generally of an hemispherical or ovate form, the base of the thorax being as broad as the shoulders of the elytra; the legs are of equal size, and not formed for leaping; the antennæ are short, and slightly thickened towards the tips; the mandibles (*fig.* 48. 6.) are notched at the extremity, and the palpi are short (*fig.* 48. 7, 8.).

These insects, which are herbivorous in the larva and perfect states, are often ornamented with the most brilliant colours, amongst which blue, green, and gold are preeminently conspicuous; and, as is usually the case in metallic-coloured insects, the variation of colour in the same species is often very great. Their motions are very slow, their broad tarsi giving them a firm hold on the leaves upon which they reside. The larvæ are hexapod, and furnished with an anal proleg, serving as a seventh leg, and emitting a glutinous secretion, by which the larvæ attach themselves to the leaves when about to undergo their transformations; some species, however, descend to the earth. The larvæ of the genus Clythra, as observed by M. Wandouer, and communicated to Latreille, inhabit hairy cases, of a leathery-like matter, which they drag about with them, protruding the head from the

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* BIBLIOGR. REFER. TO THE CHRYSOMELIDÆ.

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Marsham, in Trans. Soc. Linn. Lond. vol. ix. (Notoclea, Paropsis *Oliv.*)
Kirby, in ditto, vol. xii.
Germar. Insect. Sp. Nov. Ditto in Silberm. Rev. Ent.
Dalman. Ephemerides Entomologicæ. (Podontia, Phyllocharis and Euryope.)
Guérin. Mag. d'Entomol. (Doryphora), and Icon. R. An. Ins. pl. 48.
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Perty. Delect. An. art. Braz.
Laporte, in Silbermann's Revue Ent. No. 1. (Colaspis.)
Leach, in Trans. Ent. Soc. 1812. (2 Clythræ.)
Gebler. Chrysomelæ Siberiæ rariores, Mém. Nat. Mosc. t. vi.
Hornstedt. Beschreib. Neuer Blattkafer-arten Schrift. Berlin. Gesellsch. Naturf. fr. b. 8. p. 1-8.
Schneider. Mag. für Entomol. b. 1. p. 186. (European Cryptocephali.)
Olivier, Fabricius, Herbst, Gyllenhal, &c.

narrow end. This fact had, however, been long previously recorded in Fuessly's *Archives* (p. 53. pl. 31.). The larva, according to the last-named author, has the body curved, and not greatly unlike that of a small cockchafer. When full fed it retires into its case, in which it changes to a curved pupa. (*Fig.* 47. 9. represents Clythra tridentata ♂ (longimana *Fab.*), 10. antenna, 11. larva in its case, and 12. larva, taken out of its case, from Fuessly.) Olivier, in his *Hist. Nat. Coléoptères*, had first noticed that the larvæ in these two genera enclose themselves in a case, supposed to be formed of earth, in which they reside, and which they carry about with them. Fuessly, Hubner, Latreille, Wandouer, and L. Dufour (*Ann. Gén. des Sciences, Bruxelles*, t. vi. p. 307.), had subsequently published notices upon the same subject. M. Géné (*Annal. Scienc. Nat.* tom. xx. p. 143.) has published a "Mémoire pour servir à l'Histoire Naturelle des Cryptocéphales et des Clythres." In the spring of 1827, he discovered several of these cased larvæ on the trunk of an oak, and which were transformed, on the 15th of the following June, to Cryptocephalus 12-punctatus *Fabr.* The head of the larvæ exactly fits the orifice of the case; the antennæ are short, and 3-jointed; the mandibles triangular and bifid at the tip; the legs are very long and slender. M. Géné discovered the remarkable fact, that the case is formed of the excrement of the animal, moulded to its proper form by the assistance of its mandibles. (*Fig.* 47. 13. represents Cryptocephalus sericeus ♂, and 47. 14. its supposed larva, in a case after Fuessly.) In the *Annales de la Soc. Entomol. de France* (tom. ii. p. 39.) is a notice of a larva, found by Messrs. Thion and Percheron, enclosed in a solid case in an ant's nest, and which was considered to be that of a Cryptocephalus. Zschorn also reared C. 12-punctatus from a cased larva found on the hazel nut. (*Germar. Mag.* vol. i.)

Dr. Burmeister has published an interesting account of the natural history of the curious South American genus Chlamys, in the second volume of Wiegmann's *Archiv.* (p. 245. pl. 5.). The case, or cocoon, in which the larva of Chl. monstrosa (*fig.* 47. 15.), discovered by M. Bescke, is somewhat heart-shaped, the sides at the broad part being extended into acute angles. It was found at the foot of a balsam, attached to a twig; the larva (*fig.* 47. 16.) has very much the appearance of that of a Melolontha, being thick, fleshy, wrinkled, and curved, with six moderate-sized legs, two very short antennæ, six tubercular eyes on each side, and short triangular mandibles. The pupa state

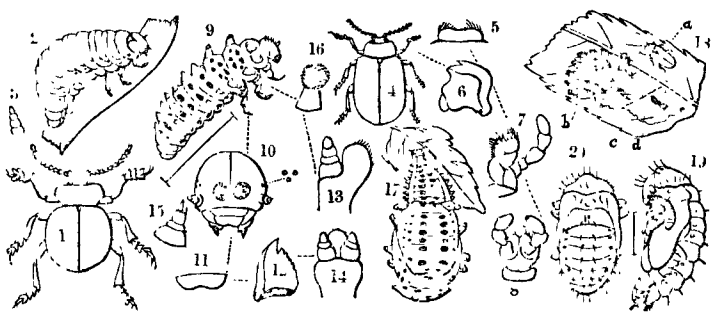
(*fig* 47. 17.) is passed inside the case, the pupa exhibiting the peculiar characters of the genus.

The genus Eumolpus comprises numerous very splendid exotic species; but the most notable is the E. Vitis, a small insect, not exceeding a quarter of an inch in length, which inhabits the wine countries of Europe, and commits great devastation upon the vines. Its larva appears in spring, and devours the young leaves and twigs, and gnaws around the stems which support the bunches of grapes as soon as they have made their appearance, thus preventing the flowing of the sap and the maturing of the fruit. It is of an oval form, with the head and six legs scaly, and two strong jaws (See the Baron Walckenaer's *Memoir upon the Insects of the Vine,* in *Ann. Soc. Ent. France,* 1836, p. 247.)

M. Léon Dufour has also noticed the ravages of Colaspis Barbara upon the lucerne (Medicago sativa), in Spain, which is entirely devoured by the larvæ of this insect. These larvæ are hexapod, black, smooth, and a quarter of an inch long; and are destroyed by the Spanish peasants by means of a large sweeping net. (*Ann. Soc. Ent. de France,* 1836, p. 372.) M. Daube has also published some additional observations, on the same insect, in the same *Annales,* p. xlvi.; and has suggested that fowls may be advantageously employed to devour these insects. (*Ann.* 1837, p. xlix.)

The genus Timarcha comprises the largest species of Phytophagous insects found in this country, and which are destitute of wings. The T. lævigata (which Linnæus placed in the genus Tenebrio, C. tenebricosa *Fabr. fig.* 48. 1.) varies in length from half to three quarters of

Fig. 48.



an inch. These insects are very slow in their movements, and emit a reddish fluid from the mouth and joints of the legs when alarmed;

whence they have obtained the name of bloody-nose beetles. The larvæ (*fig.* 48. 2., 48. 3. antenna), which I have found amongst moss and low herbage, are very thick, fleshy, and wrinkled, of a greenish-black colour, with the extremity of the body and under side dark brown or blood-coloured; the legs are of moderate size; four or five of the terminal abdominal segments are furnished beneath with small raised tubercles, capable of retraction, serving as prolegs, as well as one at the anal extremity. When alarmed, they roll themselves up, somewhat in the manner of a woodlouse. They feed upon various low-growing herbs; and in their general appearance and sluggish motions present a striking resemblance to the imago. They undergo the pupa state in the ground. Schäffer has given a very complete account of the transformations of the above-named species (*Abhandl. von Ins.* vol. iii. art. 3.), under the name of the Flugellose Blattkafer. The larva is described as feeding upon Galium Mollugo *Linn.* This author has also figured the larva and pupa of a Dipterous insect, which was found in the pupa of this beetle.

The species of the genus Chrysomela, and others separated therefrom, are distinguished by the possession of wings, and an oval or rounded body. Amongst these the Chrysomela (gen. Lina *Meg.*) Populi (*fig.* 48. 4., 48. 5. labrum, 48. 6. mandible, 48. 7. maxilla, 48. 8. labium of this species) is one of the most common species.* It is of a blue-black colour, with red elytra, tipped with black. It is found upon the willow and poplar, upon which I have found its larva, which is occasionally met with in society. This larva (*fig.* 48. 9., 48. 10. head, 48. 11. labrum, 48. 12. mandible, 48. 13. maxilla, 48. 14. labium, and 48. 15. antenna of this larva) is of an oblong-ovate form, of a dirty greenish-white colour, with numerous black scaly spots; its meso- and metathoracic segments are furnished with two large lateral conical tubercles, and the abdominal segments have also two rows of smaller dorsal and lateral tubercles, from which, as well as from the joints of the legs and mouth, drops of a fetid fluid (*fig.* 48. 16.) are emitted when the larva is alarmed. The eggs are deposited upon the leaves in clusters. The pupa (*fig.* 48. 17.) is ovate, having the exuviæ of the larvæ collected in a mass at the extremity of the body.

* Dr. Hirsch of Vienna states, that this and several other beetles, which emit a similar fluid when alarmed, are serviceable in the toothach, by bruising them with the finger, and then rubbing the latter against the teeth and gums; the efficacy of the remedy continuing for several days upon the finger.

The transformations of these insects have been figured by various authors. By Lyonnet (*Posth. Mém.* pl. 12. C. Populi and dorsalis); Albin (*Natural Hist. Engl. Ins.*, Lond. 1720, 4to. pl. 63.); Frisch (vol. i. pl. 7. t. 8.); Gœdart (No. 118.); De Geer (*Mémoires*, vol. v. pl. 8. fig. 16—22.); and by Schäffer, who has given a very elegant and complete series of figures of the natural history of C. Populi (*Abhandl. der Insect.* vol. iii. art. 4.). In the summer of 1837, I observed this species in immense profusion, in all its states, on the small sallow bushes in the Parc de Belle Vue, near Paris; the young shoots being completely destroyed in many instances. Dr. Ratzeburg has also published a very complete series of figures of the various states of the closely allied species Chrysomela (Lina) tremulæ, together with details of the structure of the mouth of the larva and imago. (*Die Forst-Ins. Col.* pl. xx. f. 3.) De Geer has also figured the transformations of Chrysomela ænea and of C. Betulæ (*Mém.* vol. v. pl. 9.), the larvæ of which are very similar to those of C. Populi; the pupa of the former, however, differs in having the abdominal segments more constricted. The same author has also figured the transformations of C. hæmoptera, the larva of which is thick, fleshy, and without the tubercles, which are so conspicuous in the preceding, and others more resembling the larva of Timarcha. The larva, according to De Geer, feeds upon the Hypericum perforatum. Dr. Heer has also described and figured the various states of a new species (C. Escheri *H.*), giving a minute analysis of the oral organs, &c., and of the mucus-secreting tubercles of the back. (*Observ. Entomol.* 1836, pl. 6.)

The larvæ of some species of this family feed, in society, upon leaves, preserving one or more most orderly rows. This is the case with a species figured by Rosel (*Insect. Belustig.* vol. ii., Scarab. terrestr., cl. 3. t. 1.), in which the larvæ are arranged in three rows, six or seven abreast; and which, from the figure of the imago, appears to be that of Chrysomela armoraciæ, or an allied species. I have also traced the transformations of the C. Vitellinæ (*fig.* 48. 18. *a*), the larvæ (*fig.* 48. 18. *b*) of which feed upon the willow, in the same manner, but only in a single row, eating only the surface of the leaf (48. 18. *d*), and leaving their exuviæ attached to its surface (*fig.* 48. 18. *e*). They were found at the beginning of September, shortly after which they descended into the earth, and assumed the pupa state (*fig.* 48. 19, 20.), and appeared in the perfect state at the beginning of October. The larva of this insect is very similar to that of C. Populi, except

that the meso- and metathoracic tubercles are not so large, and the tubercles are provided with rather long hairs. (See also *Arboretum Britannicum*, p. 1483.)

Fabricius, in his early works, detached the genus Cryptocephalus from Chrysomela, and these two groups have been subsequently regarded as the types of the two subfamilies into which this family is divided. In the first, Cryptocephalides, the head is vertically immersed in the thoracic cavity, so as to cause the body to appear like a cylinder, truncated in front; the antennæ being long and filiform (Cryptocephalus, &c.), or short and serrated (Clythra, &c.). In the second subfamily (Chrysomelides), the head is exposed, the body oval or ôvoid, the antennæ about half the length of the body, moniliform, and slightly thickened towards the tips.

Amongst the exotic genera are to be mentioned that of Chlamys of Knoch, remarkable for its short quadrate form, and the singular rugosity of the upper surface of the body; Eumolpus *Kugellan*, distinguished by the splendid metallic tints of many of the species; Lamprosoma *Kirby*, and Trochalonota *Westw.*, in which the body is almost perfectly globular; the latter, and Colaspis *Fabr.*, having bifid ungues; Doryphora, having the mesosternum produced into a porrected horn; and the New Holland genus Paropsis *Oliv.*, having strongly securiform maxillary palpi.

Sect. iv. PSEUDOTRIMERA.

The fourth and last primary section of the Coleoptera, is the Pseudotrimera; a name which, for the reasons before stated, I propose to substitute for that of Trimera of Latreille.

In the majority of these insects, the tarsi are apparently composed of only three joints, the second of which is, however, bilobed, and receives between its lobes the minute third joint, which has been generally overlooked, and the base of the fourth, or terminal joint (*fig.* 49. 18.); the antennæ are generally short, and terminated by a 3-jointed club; the elytra cover the abdomen, and are never truncated at the tips.

The habits of these insects are various; a portion frequenting fungi, and the remainder feeding upon aphides.

Latreille divides this section into three families: the Fungicolæ (or Endomychidæ), the Aphidiphagi (or Coccinellidæ), and the Pselaphii, observing that the last approach the Staphylinidæ in various

respects; with which, indeed, they are associated by our English entomologists, and which have been already described as a portion of the Brachelytra. The family Erotylidæ (Clavipalpi *Latr.*) was evidently considered by Latreille as the connecting link between the Cyclica and the Fungicolæ; but, from the structure of its pseudo-tetramerous tarsi, agreeing with those of the Chrysomelidæ, it was arranged by him amongst the Tetramera, constituting his seventh and last family of that section. The general structure, as well as the habits, of the Erotylidæ are, however, so much more analogous to those of the Endomychidæ, that it must be evidently unnatural to force the former amongst the Cyclica; indeed, they ought, perhaps, rather to be regarded as more strictly Necrophagous; in which case, the Endomychidæ would, I apprehend, be equally liable to removal, in company with them, since the large securiform palpi seems to be a character of superior value possessed by both groups.

Adopting, however, the ordinary mode of arrangement of these families, the Pseudotetramera comprises the three following families: — Erotylidæ, Endomychidæ, and Coccinellidæ; the first forming an exception to the tarsal character of the section.

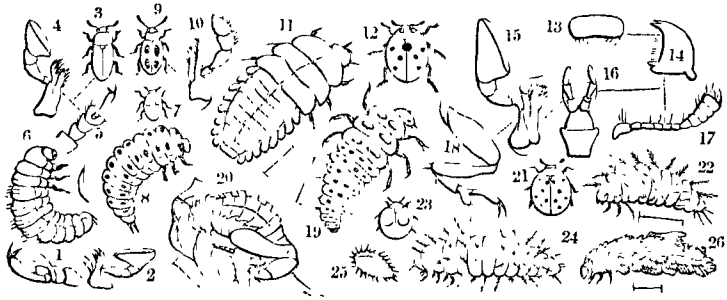
The first family, EROTYLIDÆ * (Clavipalpi *Latreille*), is distinguished by the pseudotetramerous tarsi (*fig.* 49. 1.), and by the large, flattened, 3-articulate club of the antennæ. The body is generally of an oval or hemispherical form, and of a firm and polished consistence, being frequently variegated with yellow or red upon a black ground.

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* BIBLIOGR. REFER. TO THE EROTYLIDÆ.

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Olivier, Fabricius, Stephens, &c.

Fig. 49.



The head is small, or but of moderate size; the mandibles are short, and dentate at the tips; the maxillæ are terminated by a corneous hook; the palpi are terminated by a large joint, which in those of the maxillæ is very large, compressed, and sublunate (*fig.* 49. 2.).

These insects are chiefly exotic, and but little is known of their habits; from the structure of the mouth, it is, however, conjectured that they feed upon vegetable matter; and the British species, whose economy has been observed, reside in fungi and boleti, growing upon the decaying trunks of trees, and under rotten bark, &c.

Count G. Fischer de Waldheim in his *Oryctographie du Gouvernement de Moscou* (folio, 1830), has figured an insect (fig. 49. 7.) under the name of Hallomenus fasciatus, but which from the form and colour of the body, the structure of the tarsi, and the clavation of the antennæ, appears to belong to the genus Tritoma. He has also given two figures of its larva, which bear a considerable resemblance to those of the Chrysomelidæ, having a thick, fleshy, spotted body, narrowed towards the tail, with a small head, and six short legs: the body is terminated by two short spines (*fig.* 49. 8.). The genus Tritoma is placed by Mr. Stephens in the family Anisotomidæ (having been removed from the Erotylidæ in conjunction with Phalacrus and its allies); but it is certainly most nearly allied to the Erotylidæ. Mr. Curtis has formed it into a distinct family, Tritomidæ. M. Lacordaire has given the following account of the larva of Erotylus surinamensis. (*Ann. Soc. Entomol. de France*, tom. i. p. 364.) This larva resides in boleti in Guiana, upon or in the neighbourhood of which the perfect insects of this genus are to be met with. The larva of E. surinamensis is more than half an inch long, slightly swollen at the posterior extremity, white, and destitute of asperities, except the first segment,

which supports a fleshy tubercle, from which a colourless scented fluid is discharged; the mandibles short, robust, and rather obtuse; the head is black, and can be withdrawn to the prothoracic cavity.

I am indebted to M. V. Audouin for the larva (*fig.* 49. 6.) of Triplax nigripennis (*fig.* 49. 3.; 49. 4. maxilla, 49. 5. tarsus), which he succeeded in tracing to its final state. This larva is extremely similar to that of Colydium sulcatum: it is rather short, subcylindric, somewhat curved, and rather fleshy in its consistence, with two transverse rows of short bristles on each dorsal segment. It has three pairs of thoracic legs, and an anal proleg, and the terminal segment is armed above with two short, horny, recurved points. There is unquestionably so strong a natural affinity between this family and the Engidæ, and some other Necrophaga, that the structure of the mouth is evidently here of higher value than that of the tarsi: indeed, Mr. MacLeay places the genus Languria in the family Engidæ, conceiving it allied to Helota, and describing a species which he considers forms the connecting link between Languria and Cerylon. The genera Phalacrus and Agathidium, which are introduced into this family by Latreille, have certainly but little affinity with the other species, and have accordingly been separated therefrom, as a distinct family by Stephens, and other English authors. Amongst the exotic genera, the most conspicuous are the extensive and handsome Brazilian genus Erotylus *Fab.*, having the maxillary palpi terminated by a large crescent-shaped joint; and Languria *Latr.*, having the body linear, and the club of the antennæ often 5-jointed.

The second family, ENDOMYCHIDÆ *Leach* (Fungicolæ *Latr.*), is distinguished by the pseudo-trimerous tarsi; the antennæ longer than the

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* BIBLIOGR. REFER. TO THE ENDOMYCHIDÆ.

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Guérin. Icon. R. An.
Duméril. Consid. génér. pl. 21.
Gory. Ann. Soc. Ent. de France, 1834. (Notiophygus.)
Perty. Del. An. art. Braz.
Germar. Insect. Nov. Sp.
Perty. Delect. Animal. art. Braz. (Stenotarsus)
Hope, in Griff. An. K.
Olivier, Fabricius, &c.

head and thorax; the body oval; the thorax trapeziform; the maxillary palpi filiform, or but slightly thickened, and never terminated by a hatchet-shaped joint (*fig.* 49. 10.); the second joint of the tarsi deeply bilobed or cup-shaped, receiving the minute third joint near its base, with the fourth joint elongate.

This family is but of moderate extent, consisting almost entirely of exotic species, of the habits of which nothing has been recorded. The British species are found in fungi, and under the damp bark of the trunks of trees, where they feed upon minute fungi. Lycoperdina Bovistæ, as its names imply, feeds upon the puff-ball Lycoperdon Bovista. The species are often elegantly coloured; in which respect, as well as in their general appearance and character, they are closely allied to the Erotylidæ.

We are only acquainted with the larva (*fig.* 49. 11.) of Endomychus coccineus (*fig.* 49. 9.) of which the first notice is that given by Samouelle, who says that it resembles the female glowworm. Kirby and Spence (vol. iii. 166.) also mention it, observing, however, that it agrees with that of Coccinella. Mr. Curtis subsequently gave a figure and description of this larva, which he found in a white cottony web under the bark of a decaying stump of a fir tree, and which he at first thought were young glowworms. They moved slowly, and some were attacked by a Chalcidideous parasite. They are composed of eleven segments, besides the head and apical joint, which were so deflexed as to be concealed. They have six pectoral feet; the antennæ are short and filiform; and the margins of the segments are reflexed and produced so as to form ten hooks on each side. The figure (49. 11.), which I have given of this larva is made from specimens given to me by the Rev. F. W. Hope, who found them feeding upon fungi under the bark of the willow. Mr. Curtis's figure represents the larva as more elongated than that given by me; but this has probably originated from Mr. Curtis having drawn the larva whilst alive. From this figure it will be seen that the larva is much more analogous to that of the Silphidæ than it is either to those of the glowworm or the ladybird. In the lobed form of the abdominal segments it somewhat resembles the exotic larvæ figured under the family Lampyridæ. I have not yet investigated the structure of its mouth. The antennæ are nearly as long as the head.

There are only two British species constituting the genera Endomychus and Lycoperdina. The American and East Indian genus Eumor-

phus *Weber*, distinguished by the dilated, flattened, 3-articulate club of the antennæ, comprises several extraordinary species, having the elytra furnished by a broad dilated margin, with the anterior tibiæ notched (Eumorphe de Sumatra *Duméril, Cons. Gen.* pl. 21. f. 3., and E. tetraspilotus *Hope; Griffith An. Kingd.*). Hence, Mr. Curtis seems to imagine there exists some kind of circular relation between Eumorphus and Mormolyce, thinking "it would be convenient, and even natural to put Mormolyce at the beginning of the Coleoptera and Eumorphus at the end." The relation between these two genera appears to me, however, to be nothing but the most remote analogy. My extraordinary genus Trochoideus (Paussus cruciatus *Dalm.*) evidently belongs to this family. (See *Trans. Ent. Soc.* vol. ii. p. 96.)

The third and last family of the Coleoptera, COCCINELLIDÆ* *Leach* (Aphidiphagi *Latr.*), corresponds with the Linnæan genus Coccinella, comprising the well-known insects called ladybirds or ladycows, and is distinguished by the hemispherical and convex form of the body (*fig.* 49. 12. Coccinella 7-punctata); the pseudo-trimerous tarsi (*fig.* 49. 18.); the hatchet-shaped terminal joint of the maxillary palpi (*fig.* 49. 15.); the thorax very short, transverse, and lunate; the labrum (*fig.* 49. 13.) broad, rounded at the sides; the mandibles (*fig.* 49. 14.) bifid at the tips; the labium is advanced (*fig.* 49. 16.); the antennæ often very short, with a 3-jointed flattened club (*fig.* 49. 17.); the second joint of the tarsi is large, and deeply bilobed.

The typical genus comprises insects with which every child is acquainted: their domestic habits and pretty spotted appearance

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* BIBLIOGR. REFER. TO THE COCCINELLIDÆ.

Haworth, in Trans. Entom. Society, vol. i. 1807.
Schönherr. Synon. Insect. vol. ii.
Gyllenhall. Ins. Suec. vol. iv.
Milne, in Zool. Journ. No. 2.
Brahm, in Der Naturforscher, st. 29.
Ruch, in Berlin Naturforsch. Mag. vol. iii. 1809.
Fuessly. Archiv.
Schneider, in Magasin für Entomol. vol. i. (Europ. Coccinellæ.)
Linck. Disput. Inaug. de Coccionellæ Naturâ, Viribus, et Usu. Lips. 1787, 4to. (in which the genera Coccus and Coccinella appear to be regarded as identical).
Frohlich, in Der Naturforscher, st. 28.
Paykull, in Act. Holm. 1798. (1789, Swedish Coccinellæ.)
Brahm. Arten der Coccinella, &c. bei Mainz, in der Naturforscher, No. 29.

attracting the attention of our earliest years. It is curious, also, that they have received nearly similar names of familiarity in other countries; thus, in France they are called bêtes de la vierge, vaches à Dieu, &c. These insects are amongst the most variable and difficult, as to their specific discrimination, of all the Coleoptera. The general colours are red or yellow, with black spots, varying greatly in number and size; or black, with white, red, or yellow spots. As, however, the union of individuals of opposite colours is of constant occurrence, the difficulty of investigating the species may be easily imagined. M. V. Audouin has published some interesting notes upon this subject, which appear to show that the result of the union of allied species in this group are sterile eggs. (*Ann. Soc. Ent. de France*, tom. i. p. 233.) When alarmed, they fold up their legs, and emit a mucilaginous yellow fluid from the joints of the limbs, having a very powerful and disagreeable scent, and which, according to some writers, is an admirable specific against the toothach. They creep but slowly, but fly well; they are abundant in our gardens and plantations, where, both in the larva and perfect states, they are very serviceable in destroying the aphides upon various plants. And, inasmuch as they occasionally appear in such swarms as to attract public attention, the injury done by the aphides is, by ignorant persons, attributed to the more conspicuous Coccinellæ. The eggs are deposited in small yellow patches in the midst of the plant lice; so that the larva, when hatched, is in the midst of its food. The larva (*fig.* 49. 19. larva of C. bipunctata) very closely resembles that of Chrysomela Populi; it is depressed, and somewhat of an elongate-ovate form and fleshy consistence, having the three anterior segments the largest, and the abdominal segments tubercled and spotted, and emitting a fluid similar to that of the imago, from the tubercles. The head is small; the antennæ very minute and conical, and the maxillary palpi thick. When full grown, it attaches itself to a leaf by the extremity of the body, casts off its larva skin, which is collected in a mass at the tail, *within* which the pupa (*fig.* 49. 20.) also remains attached in this state. It is remarkable for the serrated appearance of the dorsal portion of the abdominal segments. The figures which I have given are those of the larva and pupa of C. bipustulata. Mr. Dillwyn has made an observation relative to these larvæ, whence it would appear that they are not exclusively Aphidivorous, having observed them in unusually great numbers when no aphides were near, and where

there seemed nothing but vegetable food at all sufficient for such a multitude. On one occasion they appeared to consist exclusively of C. 7-punctata: each remained in the pupa state twelve days; and another pupa of C. mutabilis, which was found on the nettle at the same time, remained thirteen days. I am indebted to M. V. Audouin for an opportunity of observing the habits of Coccinella Argus (*fig.* 49. 21.) *Scriba* (Panz. 79. f. 4.; C. 11-maculata *Fabr.*) in its various states, and which he had detected upon the leaves of the common Bryonia at Sèvres, upon which the larva feeds. In the middle of the month of July we found the insect in all its states; the larva (*fig.* 49. 22.) being distinguished by the spinose spines with which the body is armed, each segment having six. On assuming the pupa state, the skin of the larva is not cast off, but a slit is made down the back, exposing the back of the enclosed pupa. The imago is about the size of C. 7-punctata, and is clothed with a very fine pubescence.* The same indefatigable observer has informed me that he has observed that C. 7-punctata is subject to the parasitic attacks of Microctonus terminalis *Wesm.*, and Encyrtus flaminius *Dalm.* The larva of the former has been observed by him to burst forth from the body of the imago of the Coccinella, spinning its web beneath the body, and therein undergoing its transformation. Much popular matter connected with these insects is collected by Kirby and Spence (vol. i. letter 9., and vol. ii. p. 9. and 230.), and in the *Gardener's Magazine*, vol. iv. p. 159. 445. De Geer has given a very complete account, with figures, of the structure and transformations of Coccinella ocellata (*Mém.* tom. v. pl. 11.), and of C. 7-punctata (*Ibid.* pl. 10. f. 14—20.); and Réaumur, in his *Histoire des Vers Mangeurs de Pucerons* (*Mém.* tom. iii. ch. 11.); Albin (*Natural Hist. Engl. Ins.* pl. 61.); Frisch (vol. i. pt. 4. tab. 1.); Gœdart (No. 112.); and Herbst (*Naturgst.* vol. v. tab. 5.); have given various accounts and figures illustrating the transformations of the different species of the genus Coccinella. Dr. Ratzeburg has also figured C. 7-punctata in its different states, with details in his work upon forest insects (Berlin, 1837).

The larva (*fig.* 49. 24.) of the genus Chilocorus *Leach* (*fig.* 49. 23. C. Cacti), is distinguished by having each of the segments of the body

* M. Léon Dufour has pointed out several important anatomical variations between C. Argus and C. 7-punctata; the former insect being destitute of the slightest trace of salivary vessels, its alimentary canal being also four or five times the length of the body; whereas it is only twice as long in the latter species.

furnished with six setose spines, arranged transversely, giving the insect somewhat the appearance of certain Lepidopterous larvæ ; when full grown, a slit is formed down the back ; but the pupa state is assumed without shedding off the outer envelope, thus approaching the coarctate metamorphosis. (De Geer, *Mém.* tom. v. pl. 10. fig. 21—25., my *fig.* 49. 25.) Notwithstanding these peculiarities, the genus is not admitted by the French entomologists. The larva of minute species of Scymnus has been observed, and exhibited to me by M. V. Audouin, to feed upon a small Phylloxera (one of the Aphidæ), which lives upon the oak : the larva is entirely clothed with a white cottony secretion. I have also myself met with this larva ; and Réaumur has described several apparently closely allied species of larvæ, which he terms 'les barbets blancs' (*Mém.* tom. iii. 11. pl. 31. fig. 20—29., and my *fig.* 49. 26.).*

Order EUPLEXOPTERA † *Westwood.*

(Dermaptera *Leach* ; nec *De Geer, Retz.* Labidoures, *L. Dufour.*)

Char. Anterior wings leathery, very small, without veins, uniting in a straight suture, horizontal, partially covering the wings.

Posterior wings large, with radiating nerves, and with numerous transverse and longitudinal folds.

Mouth with transversly movable jaws, the posterior pair being galeated.

Anus forcipated.

Pupa semicomplete, active, resembling the imago, but with rudimental wings.

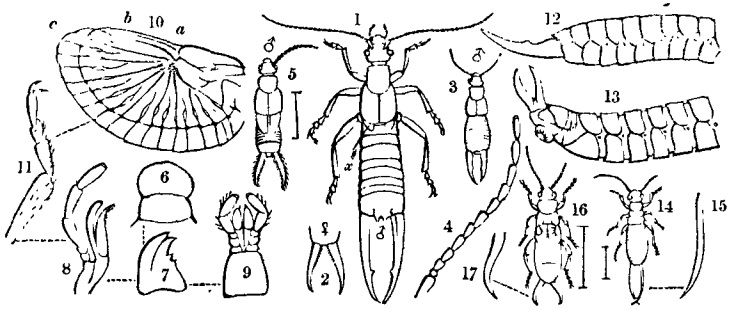
The well-known earwig (Forficula auricularia *Linn.*) is the type of this order, in which the body is of a long, narrow, and flattened

* Réaumur, in his account of the insects which attack the aphides, has described the larva of a Coleopterous insect, which he names "l'hérisson blanc," or "le barbet blanc," of small size, and remarkable for having the body clothed with small bundles of oblong, white, cotton-like "touffes," and furnished with six legs. The beetle produced from these larvæ is of minute size, of a rounded form ; the elytra olive-brown, with some brown spots. I have met with this larva, but have been unable to rear it : it evidently, however, belongs to some species of the genus Scymnus.

† Bibliogr. Refer. to the Euplexoptera (Forficulidæ).

Unzer. Von einem Ohrwurme der seinem Unterleib aufgerissen. Samml. klein. Schrift. No. 37.

Fig. 50.



form, having a great resemblance to that of the Staphylinidæ (*fig.* 50. 1. Forficesila gigantea, ♂, *fig.* 50. 5. Labia minor).

The head is of a moderate size, flat and narrowed behind into a short neck. The eyes are small and lateral; the ocelli are wanting; the antennæ are long and slender, composed of a number of joints, varying from ten to far beyond twenty-five, in some of the exotic species. The mouth is mandibulated, resembling that of the true Orthoptera; the clypeus being very distinct, and as large as the true labrum (*fig.* 50. 6.); the jaws are small, but robust, with a notch near the tip (*fig.* 50. 7.); the maxillæ are elongated, the inner lobe being armed with small spines at the inner margin; the outer lobe forms a small galea or sheath (*fig.* 50. 8.): the palpi are filiform, 5-jointed, the two basal joints being very short; the mentum is large

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Posselt. Tentamina circa Anatomiam Forficulæ, 4to. Jena. 1800. Ditto, in Wiedemann Arch. für Zool. vol. ii.

Leach, in Zool. Miscell. vol. iii.

Dufour. Recherch. Anat. sur les Labidoures ou Perce-oreilles, in Ann. Sc. Nat. tom. xiii. Ditto, in Ann. Gen. Sc. Brux. 1820.

Serville. Revue Méthodique de l'Ordre Orthopt. in Ann. Sc. Nat. tom. xxii.

Audouin and *Brullé.* Hist. Nat. Ins. tom. ix. 1836.

Westwood, in Guérin Mag. Zool. 1836. Ditto, in Royles Himalaya. Ditto, in Proceedings Zool. Soc. 1837. Ditto, in Trans. Ent. Soc. Lond. vol. i.

Géné. Saggio di una Monografia della Forficule Indigene, in Ann. Sc. Regn. Lomb. Venit. second year, and Ditto in ditto. 1833 (an additional species).

Charpentier. Horæ Entomologicæ.

Germar. Fauna Ins. Europ.

Nov. Act. Nat. Cur. vol. vi.

Rambur. Faune Andalous. No. 2.

Stephens, Curtis, Fabricius, Palisot Beauvois, &c.

and leathery, the labrum bifid, and the labial palpi short and filiform (*fig.* 50. 9. These details are from F. auricularia). The thorax is separated into the three ordinary segments; the dorsum of the prothorax (pronotum) forms a flattened plate, nearly as large as the head, truncate in front, rounded behind, and margined. As these insects are good walkers, and the legs of equal size, it is essential that the sternum of each of the three thoracic segments should be nearly equally developed, and such is the case. The insects are also fliers; but the posterior wings alone assist in aerial motion, the minute tegmina, or fore wings, being apparently incapable of rendering it any assistance. The tergum of the mesothorax is therefore very short (without any prominent scutellum), whilst that of the metathorax is large and nearly square: it is divided into two parts in a curious manner, the interior angles of the lower wings being produced internally in a narrow band, until they meet in the middle of the back, and are directed backwards in a point. The fore wings are very small, scarcely concealing more than a fourth part of the abdomen; the hind wings are large, and, when expanded (*fig.* 50. 10.), present a beautiful appearance; each wing constitutes more than the quadrant of a circle; and, at a short distance along the front margin of the wing, is a broad leathery patch, which is the small part of the wing, which is unprotected by the fore wing, when the insect is at rest (*fig.* 50. 1. *x*). It is therefore essential that this part should be of a firmer consistence than the remainder of the wing: moreover it serves as a place of attachment (*fig.* 50. 10. *a*) for the numerous radiating veins by which the wing is traversed, and which are thickened in the middle (i. e. at the distance of two thirds from the base of the wing, *fig.* 50. 10. *b*); another transverse vein runs parallel with the posterior margin of the wing between the radiating veins. There is also a series of shorter veins, extending from the middle to the posterior margin of the wings. On examining an earwig with the wing extended, it seems astonishing how such a large pair of organs can be folded into so small a space; but this is effected in a beautifully simple manner. The membrane of the wing itself is very delicate, and the action of the radiating veins, in closing the wing, is exactly that of the bars of a fan. The wing (or rather the apical two third portions of it) is thus longitudinally folded into a very small space, and it is then transversely folded at the part (*fig.* 50. 10. *b*) where the radiating nerves are thickened; and a second transverse fold

takes place at the extremity of the leathery patch above mentioned.* This complicated action requires the assistance of other parts of the body; and the abdomen, from its great length, is employed in folding and unfolding the wings. As in the Staphylinidæ, from being exposed, the upper surface of this part of the body is of as firm a consistence as the under.† This part of the body presents a remarkable modification in the sexes; being composed, in the males, (*fig.* 50. 12.) of nine distinct segments, the last of which is furnished, in addition to the caudal pincers, with an exserted anal apparatus; the thirteen segments of which the body of an annulose animal is supposed to be typically composed, being here fully and nearly equally developed; a circumstance of very rare occurrence in the perfect state. In the female, however, the abdomen (*fig.* 50. 13. stretched out) apparently consists but of seven segments; and it is thus described by Géné, Brullé, Curtis, &c. These segments are of nearly equal size above; but, when seen from beneath, there appear to be only six, unless the insect throws up its tail, the sixth ventral plate being much produced, and concealing a pair of lateral triangular plates, which have the angles brought into contact at the extremity of the body, when at rest, but which, when opened, form the anal passage; besides this, the pair of large terminal forceps, and a small corneous central appendage, are to be noticed. On distending the abdomen of the female, however, with a view to the discovery of the two lost segments, which exist in the male, no trace of them can be observed from beneath; but from above there are to be perceived, at the base of the last, or as it appears the seventh, abdominal segment, two slight transverse impressions; which, on being observed laterally, are found to terminate in two ventral membranes. It cannot, therefore, be questioned, that these are the traces of the two segments (the seventh and eighth), which, in the males, are as fully developed as any of the others; but the situation of the spiracles

* Le mode tout particulier de structure de leurs ailes, et la manière dont elles sont plissées, distinguent les Forficules de tous les autres insectes." (Brullé, *Hist. Nat. Ins.* t. ix. p. 19.) It is upon this character that I proposed for these insects the name of Euplexoptera (ευ, bene; πλέχω, plico; and πτερον, ala), in the nineteenth number of the *Zool. Journal* (1831.)

† In many species, the posterior dorsal margin of the second and third segments is furnished with a pair of corneous tubercles. In a curious species from Manilla (F. tarsata *Westw. Proc. Zool. Soc.*), the abdomen of the male is simple; but in that of the female the posterior lateral angles of the segments are armed with a strong point and the posterior dorsal margin is furnished with a row of small tubercles.

most fully confirms this opinion. These spiracles are extremely minute, and entirely hidden, either behind the scapular plates of the thorax, or the imbricated portion of the abdominal segments. Those of the meso- and metathorax were overlooked by L. Dufour, in his memoir upon these insects; and he did not state the number of abdominal spiracles, of which there are seven pairs, which, with those of the pro-, meso-, and metathorax, make ten pairs of spiracles placed on as many consecutive segments. This portion of the structure of these insects has formed the subject of a memoir, published by me in the *Trans. Ent. Soc. London*, vol. i., to which I must refer for further details. The remarkable corneous appendages with which the extremity of the abdomen is armed are employed as a pair of forceps*, and as instruments both of offence and defence. They vary considerably in the sexes; those of the males being always largest and most curved, as well as armed with horny protuberances (*fig.* 50. 1. male, 50. 2. caudal forceps of female: F. gigantea). In some exotic species they are singularly contorted, as in a species which I have figured in Prof. Royle's work on the Himalaya (F. macropyga *W.*); whilst in a fine Mexican species, unique, in my collection, they are straight, slender, and nearly equal to the entire length of the body. (F. parallela *Westw.* in *Guér. Mag. Zool.*) In the females they are generally short, simple, and but slightly curved at the tips. The tarsi (*fig.* 50. 11.) consist of only three joints, of which the second is the shortest, and often dilated beneath with a small pulvillus between the ungues.

The internal anatomy of these insects has formed the subject of memoirs by Marcel de Serres and Posselt; but the most complete treatise in this respect is that of M. L. Dufour, above referred to.

The ordinary name of this insect, in almost every European language (earwig; perce-oreille in French; ohren wurm in German; ören-metel, öron mask, örnvist, örnstert, in Swedish, &c.; auricularia by the later Roman writers), has given it a character which causes a feeling of dread even at the sight of it; and has reference to a widely-spread fancy that the insect creeps into the ears of sleeping persons. ("Aures dormientium interdum intrans, spiritu frumenti pellenda." *Linn.*). Their nocturnal habits may, indeed, by chance, have induced them to take shelter in the ear of persons sleeping on the ground whilst crawling about in the night; but the disagreeable odour of the

* Hence the name Forficula, given to these insects by the old naturalists.

wax would soon induce them to make their retreat; and, at all events, they could never get farther than the drum, which completely closes the passage to the brain. (*Ins. Trans.* p. 103.) During the day, they creep into all kinds of crevices*, coming abroad and feeding by night; at which time only they willingly expand their wings. They devour the corollas of flowers, especially rendering the dahlias unsightly; they also feed upon ripe and decayed fruits and other vegetable substances.

Sometimes they occur in immense profusion; of which an instance is recorded in the Historical Chronicle of the *Gentleman's Magazine* for 1755, under the head of Stroud (*Hone's Every Day Book*, vol. ii. p. 1099.), when they destroyed not only flowers and fruits, but even cabbages.

They do not appear to be naturally carnivorous; though, if kept without their ordinary nourishment, they will occasionally attack and devour their own species.†

Thus, De Geer records that the young ones observed by him devoured the dead body of their mother, as well as such of their brethren as happened to die. Mr. Kirby (*Trans. Linn. Soc.* vol. iii. p. 248.) also noticed, in a few instances, Forficula auricularia upon ears of wheat infested by Thrips, and inquires whether it does not devour them? Mr. Gorrie also states that the earwig destroys the larvæ of Cecidomyia Tritici, three of which he successively presented to an earwig, which devoured them immediately. (*Loudon's Mag. N. H.* Nov. 1829.)

In the *Field Naturalist*, p. 131., there is a short note, in which the objection of the earwig to make use of its wings, in order to escape from a piece of floating cork, is shown; and in which it is further stated, as a proof of their flying by night, and occasionally in swarms, that in a small space, of 18 inches square, upon palings fresh coated

* They are fond of crawling into the attenuated spur of the nasturtium as far as they can penetrate, leaving the abdomen sticking up amongst the pistils and stamens. It is owing to this habit that the florists stick up lobsters' claws amongst their flowers into which the insects creep, and are easily destroyed. In the Horticultural Gardens at Chiswick, bits of reed with the ends plugged up, leaving only a small entrance, are hung about the wall-fruit trees for the like purpose. Mouffet tells us of the "ox-hoofs, hogs' hoofs, or old cast things," used as traps for them by the English women, "who hate them exceedingly, because of clove gilliflowers that they eat and spoyl." (*Theatr. Ins.* p. 172.)

† I kept two females alive in a little box together for a very long time, without food; but they did not attack each other.

with pitch on the preceding day, no less than fifty or more of these insects had been captured, some of which had still their wings expanded; the lesser earwig (Labia minor, *fig.* 50. 5.), however, flies in the afternoon, and about sunset in hot weather. Kirby and Spence record some circumstances connected with the flight of this insect (*Introd.* vol. iv. p. 514.), and which takes up its abode in dung-heaps, melon-frames, &c. (see, also, *Mag. Nat. Hist.*, No. 21., for additional notes on the habits of this species.) Forficesila gigantea (discovered by the Rev. W. Bingley on the West Beach, near Christchurch, in 1808 *) seldom or never quits its hiding-place in the day-time, but runs about the sand at high-water-mark, in the twilight. On confining several in a box together, one was frequently devoured by the rest. (*Trans. Linn. Soc. Lond.* vol. x. p 401.) Dufour states, that the food of this species is small invertebrated animals.

These insects are subject to the attacks of parasites; Mr. Davis having informed me that F. auricularia is attacked by one of the Ichneumonidæ; and Dufour has described a species of Filaria and a Gregarina which infests the same insect. (*Ann. Sci. Nat.* April 1828.)

Forficula biguttata (bipunctata) is found in society under stones in the alpine region of the Continental mountains, F. lividipes (*Dufour*, F. pallipes *id. olim*) also resides in society, in the hotter parts of Spain.

These insects, or at least F. auricularia, exhibit a remarkable degree of instinct in the manner in which the females guard their eggs. It is to Frisch (*Beschr. Ins. in Deutchsland.* th. viii. p. 32.) and De Geer (*Mémoires*, vol. iii. p. 548. tab. 25.) that we are indebted for the interesting account which has been given of these circumstances. In one instance, De Geer discovered a female brooding over a number of eggs with the greatest solicitude, and which she collected into one spot on their being disturbed. On another occasion, De Geer found, under a stone, a female earwig accompanied by a numerous brood of newly hatched young, which crowded beneath her like chickens under a hen. In the *Penny Magazine* (May 12. 1832) is a short notice, in which the female is stated to have shown as much care in the welfare of her eggs as the ants are known to do, moving them from place to place in order to obtain a due supply of moisture. These eggs are

* Although repeatedly sought after, this fine species has never since occurred in England; and its claim as a true native species is, consequently, doubted by Mr. Kirby. Mr. Stephens, however, does not hesitate in considering it as British.

deposited (by Forficula auricularia ♀) in cavities in the earth, beneath stones, or in places which the parent insect has scooped out. This takes place in the spring and early summer months, soon after which the young are hatched: they are at first very small but active (*fig.* 50. 14. larva of F. auricularia, 50. 15. one side of its caudal forceps) the antennæ are shorter than in the perfect insect, having only eight, and subsequently nine, joints*; whereas there are fourteen in the perfect insect. The head is of a comparatively larger size; the body is destitute of wings or wing-covers; and the anal forceps is weak, and rather resembles two long nearly straight styles. De Geer figures them as divaricating; which is not, as far as I have seen, correct. Its size increases at each shedding of the skin, of which it undergoes several: the wing-covers first make their appearance. In the state (*fig.* 50. 16., 50. 17. one side of the caudal forceps) immediately preceding the final moulting, the wings are also present in a rudimental state, and the forceps has almost assumed its final form. I have seen no pupa, which, I should be led to judge from the larger size and form of the forceps, would produce a male insect. M. Dufour has, however, represented the forceps of a male pupa of F. auricularia (pl. 20. fig. 8.) as villose, in which the basal part is broad and toothed, and the terminal part strong, and incurved. In some pupæ which I possess, and which would, I presume, produce female insects (judging from female earwigs which I possess, which have died in the act of disengaging themselves from the pupa skin, in which they remain partially enveloped); the antennæ are 12-jointed; the mesothorax is nearly transverse, the wing-covers occupying its thickened sides; but scarcely extending beyond the posterior margin of the segment; and the metathorax is furnished with two rudimental wings, which extend to a considerable distance over the base of the abdomen, the radiating nervures being clearly discernible through the skin with which they are clothed; thus showing that the wings are expanded, and not folded up in this state. I have not observed whether the distinctions described as indicating the sexes externally are manifested in these

* In General Hardwicke's collection of drawings of Indian objects of natural history, now in the British Museum, is contained a highly magnified figure of a larva, with the thoracic segments elongated; the femora very broad; and the antennæ about four times the entire length of the body, and multi-articulate. I presume this is the larva of the Forficula figured in the following plate, which has also the antennæ multi-articulate, but much shorter, and the femora broad and flat.

insects whilst in the larva and pupa state, or whether the female larva has fewer segments in the abdomen than that of the male. There are several species, however, which are constantly observed to be apterous (Chelidoura *Latr.;* Forficula, section *c.*, *Géné*), and which are nevertheless regarded as perfect insects; a peculiarity not, however, confined to this tribe of insects: others possess perfect wing-covers, but are destitute of wings (*fig.* 50. 3., Apterygida *Westw.*, 50. 4. its antennæ; Forficula, section *b.*, *Géné*, by whom three species are described).

These insects are generally of obscure colours, and of small or but moderate size, not much exceeding an inch in length. The number of species is but small, there not being more than seven or eight British species. They are widely dispersed, probably no country being destitute of them. I possess species from North and South America, the Cape of Good Hope, India, New Holland, and the Sandwich Islands. The range of individual species also appears to be great, Thunberg having brought F. auricularia from Japan. (*Dahlbom Kort Skandinav. Ins.* p. 101.)

By Linnæus, and even by Marsham, these insects were considered as Coleopterous*, but placed at the end of the order immediately following Staphylinus. From this order, however, Forficula differs in the mouth, and more especially in the nature of its transformations; and it was accordingly united, by Fabricius, Olivier, and Latreille, with the cockroaches, crickets, &c., in the order Orthoptera *Oliv.* (Ulonata *Fabr.*). At the suggestion of Dr. Leach (who regarded the variations of the wings and wing-covers as of primary importance), Mr. Kirby (*Linn. Trans.* vol. xi.) first raised them to the rank of a distinct order, to which the name of Dermaptera (proposed by Retzius for the bugs) was misapplied.† More recently, L. Dufour has shown the wide separation existing between these insects and the other Orthoptera by his admirable anatomical analysis above referred to; but, rejecting the name of Dermaptera, he retained that of Labidoures, originally proposed by Duméril (*Zool. Anal.* 1806, p. 237.). Subsequent English, as well as some of the French, writers have retained this as a distinct order; but Latreille, and numerous followers, have

* The earwigs "are, in fact, Coleopterous insects, with the metamorphoses and caudal appendages of the true Orthoptera." (MacLeay, *Horæ Ent.* p. 437.)

† It is on this account that I have been compelled to propose a new name for the order.

considered it as a portion of the Orthoptera; with which, indeed, in the structure of the mouth, and the nature of its transformations, it certainly corresponds; the chief difference between them arising from the diversified structure and folding of the wings and wing-covers; in which respect it bears a relation to the Coleoptera, but certainly far weaker than that which it possesses towards the other Orthoptera; which also vary amongst themselves in the nature and position of the organs of flight. It is on these grounds, and more particularly in respect to the nature of their internal organs, that the earwigs are to be regarded as an osculant order, intervening between the Coleoptera and Orthoptera, but most nearly related to the latter.

As the order consists but of a single family, FORFICULIDÆ *Steph.*, it will not be necessary to enter into any further details as to its characters. Dr. Leach divided the order into three genera, from the number of joints of the antennæ; namely, Labidura, 30 joints; Forficula, 14; and Labia, 12. The precise adoption of this character amongst the foreign species would, however, necessitate the introduction of a far greater number of genera; Latreille accordingly reduced Leach's genera to two, characterised by their having fewer or more than 14 joints: he, however, added another genus, Chelidoura, for the species which do not acquire wings. More recently, Serville has proposed various additional genera, or rather subgenera, in his memoir above referred to, amongst which may be mentioned Pyragra, founded upon a large species from Cayenne, with 40 joints to the antennæ; and Apachyus (Forficula depressa *Pal. B. Orth.* pl. 1. f. 5.), the body of which is not thicker than a card. M. Brullé has reduced all these genera to the single genus Forficula; instituting only two sections, from the greater or less number of joints of the antennæ; a step which certainly appears to me to be exceptionable.

ORDER ORTHOPTERA* *Olivier.* (HEMIPTERA p. *Linnæus.* DERMAPTERA *De Geer.* HEMIPTERA, nec. DERMAPTERA *Retzius.* ULONATA p. *Fabricius,* DERATOPTERA p. *Clairville.*)

CHAR. Anterior wings (tegmina) pergameneous, large, thickly veined, overlapping at the tips.

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* BIBLIOGR. REFER. TO THE ORTHOPTERA IN GENERAL.

Stoll. Représentations des Spectres, Mantes, et Sauterelles, &c., 4to. Amsterdam, 1780—1788.

Posterior wings large, thickly reticulated, folded longitudinally.

Mouth with transversely movable jaws, the posterior pair being galeated.

Anus often styliferous.

Pupa semi-complete, active, resembling the imago, but with rudimental wings.

This order comprises numerous well-known insects, often of large size and splendid colours, and of which the common cockroaches, soothsayers, walkingsticks, and leaf insects, grasshoppers, crickets, and locusts, are the types of the various families of which it is composed.

The body is in general much elongated; in some, however, it is shorter, subovate, and depressed (Blatta). The head is, in general, large, corneous, and vertical, with the mouth occupying its inferior posterior part. The antennæ are often very long and filiform, and composed of a great number of minute simple joints. Amongst the locusts, however, and some of the female leaf insects, the number of joints is comparatively small; and in others these organs are pectinated (as in some of the Mantidæ). The eyes are, in general, large, and the ocelli two or three in number, but often more or less obsolete. The upper lip is generally transverse, but rounded in front, and attached to the clypeus (which is also very distinctly articulated at the base), generally covering the mandibles, except the sides, at the base. The mandibles are very robust and horny, often sub-triangular, rounded externally, but internally formed for biting, and armed with several teeth; the left mandible being generally more toothed than the right, the inner surface of which is more irregular, in order to fit

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Thunberg. Dissertatio Entomol. de Hemipt. Maxill. Capensibus. Upsal, 1822.— Ditto, Hemipt. Maxill. Genera Illustr. &c., in Mém. Acad. Sc. St. Petersb. t. v.

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Charpentier. De Orthopteris Europæis in Horæ Entomol. Wratislav. 1825.

Audouin and *Brullé.* Hist. Nat. Ins. vol. ix. 1836.

Say. Orthoptera of the Rocky Mountains, Journ. Acad. Sc. Philad. t. iv.

Serville. Révue Méthodique, in Ann. Sc. Nat. tom. xxii.

Marcel de Serres. Anatomy Orthopt. Ann. du Mus. tom. xii. xiv. and xvii.— Ditto, On the Eyes of the Orthoptera, Journ. de Physique, No. 58.

Ahrens, Fabricius, Perty, Drury, Donovan, De Geer, Fuessly, Hagenbach, Rösel, Olivier (Enc. Méth.), *Palisot Beauvois.*

the other. In Cerberodon *Perty*, the left mandible is disproportionately produced into a long and curved point, far exceeding the other mandible in length. The lower parts of the mouth arise close to the point of union between the head and prothorax; the maxillæ are often horny, strongly elbowed near the base, the basal portion being transverse; the stipes of the maxillæ is elongated, and the two terminal lobes very distinct; the outer lobe (galea) is more or less dilated, with a short joint at the base, hollowed on its inner margin, thus serving as a shield for the inner lobe, which is long, acute, and armed with two or three teeth. The mentum is large and transverse, and narrowed in front; the labium large and coriaceous, and divided into four lobes, of which the external pair are so large, and bear so much analogy to the galeated portion of the maxillæ, as to lead to the conclusion that the labium and its appendages are, in fact, an additional pair of maxillæ, soldered together. The tongue (lingua) is also here greatly developed, constituting a large and separate organ, occupying the middle of the mouth, being fleshy, channelled above, and rounded at the extremity. The thorax is analogous as to its construction with that of the Coleoptera; the prothorax being large, and offering traces on its upper side, in some species (Locusta), of the four divisions of which the thoracic segments are typically composed. The meso- and metathorax are closely united together, the front of the former being defended by the posterior part of the pronotum*; the mesothoracic scutellum is not prominent; the anterior wings, or tegmina, are of a texture which Mr. Kirby has termed pergameneous (somewhat like parchment); they are strongly and thickly veined, and generally cover the posterior wings; their position is various in the different families; in some being horizontal, in others deflexed (roof-shaped), and in some partly deflexed, and partly horizontal (crickets). In some species, the fore wings are alone present (Phyllium ♀), in some others the hind wings are developed, whilst the fore wings are greatly reduced in size (many Phasmidæ); and, indeed, in one species (Aschiphasma hieroglyphica *W.*)†, the fore wings are

* In some species of Acrydium (Tetrix *Latr.*), Hyperhomala virescens *Bdv.*, &c., the prothorax is greatly developed, extending over the whole abdomen.

† Perlamorpha hieroglyphica *Curtis*, *Gray*; Aschiphasma annulipes *Westw. Zool. Journ.* The hybrid nature of the former generic name will permit the retention of mine, which was published subsequently to Gray's *Synopsis*, owing to the great delay which occurred in the publication of the last Number of the *Zool. Journal.*

entirely obsolete, being the only known instance in which hind wings exist without fore wings. Many species, however, remain apterous or subapterous throughout their whole lives, whilst others have one sex winged, and the other apterous or subapterous. The posterior wings are large, membranous, strongly reticulated with veins, and longitudinally folded when at rest, the principal veins being disposed somewhat like the bars of a fan; the legs are long and robust, of various structure, raptorial in the Mantidæ, cursorial in the Blattidæ, ambulatorial in the Phasmidæ, fossorial in Gryllotalpa, saltatorial in the locusts, &c.; the tarsi are uniform in the number of the joints in all the legs, not exhibiting that variation found in the heteromerous Coleoptera; the joints (with the exception of the terminal one) are generally spongy or leathery on the sole; the penultimate joint often bifid, and the terminal joint often with pulvilli between the ungues; the abdomen, as in the Coleoptera, is attached to the posterior part of the thorax by its whole breath, composed of eight or nine distinct segments; the extremity of the body being often furnished with articulated appendages or setæ, which in the crickets are of great length, and exist in both sexes; in the locusts, however, these appendages are wanting. The females are, moreover, in some groups, furnished with an exserted corneous ovipositor.

In their internal anatomy, these insects exhibit so superior a degree of developement, as to have led M. Marcel de Serres (who has published a very elaborate memoir upon the subject in the *Annales du Muséum*, tom. xiv. and xvii.) to regard them as entitled to the foremost rank amongst insects. The saltatorial species are especially remarkable for the apparent multiplicity of their stomachs, of which four have been attributed to the mole cricket (Gryllotalpa), of which the first is round and membranous, from which proceeds a very short canal, which conducts to a second stomach or gizzard, shorter than the preceding, but muscular, and furnished internally with scales, or horny points, or teeth (analogous to the teeth found in the stomach of the Crustacea), arranged in five longitudinal series*, each composed of ten or twelve small laminæ, performing a sort of peristaltic motion by

* There are six longitudinal divisions in the mole cricket, each composed of three series of serrated teeth; and, as there are fifteen teeth in each of the three series of the six divisions, the gizzard contains 270 teeth. (Kidd, in *Phil. Mag.* 1825, p. 414.; and see a memoir on the anatomy of the mole cricket by Hoeven, *Bull. des Sc. Natur* Jan. 1831; and also by Jacobæus in *Bartholini Act. Hafn.* vol. iv.)

the muscular action of the organ. The other two stomachs are placed near the orifice of the intestine.

Some of these insects (Blattæ) are omnivorous, and others (Mantidæ) carnivorous; but the majority of them are herbivorous; and, as vegetable food is less nutritious than matters already animalised, a much greater supply is required; whence it follows, in conjunction with their large size and immense numbers, that some of these species are amongst the most voracious, and consequently the most destructive, of the insect tribes: this is especially the case with the locusts. Their powers of propagation are also exceedingly great; so that in some of the warmer quarters of the globe they become perfect pests.

The transformations of these insects constitute one of the chief characteristics of the order. The larvæ very much resemble the perfect insects, except that they are much smaller, and are destitute of wings: they shed their skins several times. The pupa differs only from the larvæ in the possession of short rudimental wings and wing-covers, which, at the first period of this state, are but slightly to be perceived. The insect, in this state, is active and voracious: after the final moulting (ordinarily the sixth) the wings and wing-covers appear of their ordinary size, and the insect possesses all its powers. Many of these insects are eminently musical: this is the case, I believe, throughout the whole of the saltatorial species, including the crickets and grasshoppers, &c.

The order comprises some of the largest of known insects; some species being eight or ten inches in length, and in the expanse of their wings. Comparatively few species inhabit our own country, the majority being found in the tropics. The large green grasshopper and the mole cricket are amongst the largest of our native insects. It is, however, in the torrid regions of the globe that these insects are found of all the richest colours; the only metallic-coloured species, however, which I have seen, is one of the Mantidæ, from Malabar (Metallyticus splendens *Westw. Zool. Journ.* and *Brit. Cyclop.* pl. Orth. Ins.).

All the known species of this order are terrestrial. Stoll has, indeed, represented a remarkable insect, under the name of "le grillon aquatique cornu," found "dans des eaux croupissantes," at the Cape of Good Hope; but I apprehend there is an error in this statement. These insects were at first arranged by Linnæus, as well as by Geoffroy, with the Coleoptera, from their tegmina covering the hind wings; and in the later works of the great Swede they were united

with the suctorial Hemiptera, from the less firm nature of their wing-covers. It was De Geer who first saw the impropriety of suctorial and biting insects being retained in the same natural order; and he accordingly separated them as an order; for which his commentator, Retzius, retained the name of Hemiptera, giving that of Dermaptera * to the suctorial species. Olivier, who was probably unaware of the little work of Retzius, proposed the name of Orthoptera for these mandibulated insects, derived from ὀρθος, straight, and πτερον, a wing, in allusion to the longitudinal folding of the hind wings; which name has been generally received in preference to that of Ulonata †, given to them by Fabricius. Dr. Leach restricted the order to the Mantidæ, Phasmidæ, and saltatorial species; forming the Blattidæ into an order, under the name of Dictyoptera, chiefly from the different manner in which the fore wings lap over each other, and the depressed form of the body; but these differences are really too trivial to be adopted as of primary importance.

Whilst the relation of the Orthoptera with the Coleoptera, by means of the earwigs, is admitted by all writers, there is also an equally close affinity to be observed between them and the Neuroptera. The Neuropterous genus (Perla, for instance), and the Orthopterous Phasmidæ, are not far apart in a natural system, there being a very great resemblance in the structure of the mouth, and the nature of their metamorphoses. Mantispa ‡ and Hoplo-

* I find, whilst this sheet is going through the press, that although De Geer, in his table of the orders of insects given in his vol. vii. p. 862., did not employ the term Dermaptera (which Retzius subsequently applied to the Heteropterous Hemiptera), yet in the body of his work (vol. iii. p. 399.), *he* had proposed it for Blatta mantis Gryllus *Lin.* and Forficula. Misled by the misapplication of the name by Retzius, I have employed the name Orthoptera, but that of Dermaptera ought certainly to be used in its stead. My note in p. 21. *ante* will consequently require revision.

† Mr. Kirby states the derivation of this name to be uncertain (*Introd.* vol. iv. p. 451.); suggesting Αυλον as its base; but it is evident from the character given to the order by Fabricius, "maxillæ covered," that the term was derived from οὖλον gingiva, and γναθος.

‡ This remarkable genus has been alternately treated as Orthopterous and Neuropterous by Latreille, in his numerous works. Mr. MacLeay (*Horæ Entomol.* p. 440.) scarcely conceived it to offer any type of form distinct from Mantis, differing only in its Neuropterous wings, but agreeing in the construction of its mouth, thorax, and feet with Mantis. On dissection, I find, however, that the maxillæ, although bilobed, cannot be called galeated; and that the lower lip is entire, and not quadrifid, as in all the true Orthoptera. The extremity of the body is, also, unfurnished with articulated appendages. Hence, I have no hesitation in regarding it

phora* *Perty* (Mantoida *Newm.*), as well as the curious Panorpideous genus Boreus (Gryllus proboscideus *Panz.*), are also genera sufficiently proving the close relation which exists between the Orthoptera and Neuroptera. If we regarded the nature of the wings as of higher importance than that of the structure of the mouth, we should be led to adopt the close relation of the Orthoptera with the Suctorial Homoptera†; there being not only a great degree of resemblance between the substance and position of the wings when at rest, but some of the insects in both these orders exhibit in a remarkable degree a resemblance in the occasional want of developement of these organs in certain individuals; whilst other individuals of the same species, under peculiar circumstances, acquire fully developed wings; it being evident that the former individuals do not continue pupæ, because they are of a form quite different from the real pupæ in those individuals which subsequently acquire wings.

Latreille, in his earlier works, divided the order into FIVE sections (exclusive of the Forficulidæ), having Blatta, Mantis, the locust, cricket, and grasshoppers with long antennæ, for their types.

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as Neuropterous, and not Orthopterous, and as forming a distinct family, allied to Raphidia in its elongated prothorax, and widely reticulated and deflexed wings; and to Hemerobius and Myrmeleon in its mouth and antennæ. The raptorial structure of the fore legs is the only character it has in common with Mantis. The mandibles are like those of Hemerobius.

* This remarkable genus is regarded, both by Perty and Newman, as allied to Mantispa; its more important characters are, however, those of the Mantidæ: the form of the mandibles, the elongated antennæ, the quadrifid labium, and the "multi-articulated" appendages at the anus, indicate this affinity, and at the same time prove its relation with Mantispa to be but analogical. Perty describes two species, Hoplophora valida and H. tenuis; in one of which the three ocelli are visible, and in the other obsolete. I have, therefore, no doubt that his species are the sexes of the same insect. Mr. Newman has shown me the insect which he described; and its fore wings have four longitudinal nerves; the subcostal one extends to the tip; the next divides into two branches beyond the middle of the wing; the third is divided into three branches towards the base; and the internal one is divided into two branches close to the base. The second and third are united together by a strong transverse nerve; besides which are numerous slight veins running between the longitudinal nerves.

† It will be seen by a reference to p. 27., that Mr. MacLeay makes the Orthoptera analogous to the Suctorial Cimicidæ; but a much stronger analogy exists between them and the Homoptera; founded, first, on the uniform structure of the anterior wings; secondly, on the saltatorial powers; and, thirdly, on the musical powers of the typical species of both groups.

This arrangement has been adopted by MacLeay in the *Horæ Entomologicæ*, by whom they were named Blattina, Phasmina, Acridina, Locustina and Gryllina; Brullé, also, in his recent arrangement, has adopted the same mode of arrangement, but separating Phasma and Mantis, which had previously been most unnaturally united together. Latreille, however, in his later works, divided the order primarily into two sections, Cursoria and Saltatoria; the latter corresponding with the Linnæan Grylli, and the former containing Forficula, Blatta, Mantis, and Phasma.

The union of all the Saltatorial species into a separate section appears a decided improvement; but the group, thus constituted, appears to be of no higher rank than either Blatta, Mantis, or Phasma; and, therefore, the former mode of arrangement, in which those types were reduced to a rank equivalent only to the crickets or locusts (and not to the entire Saltatorial group), was equally untenable. Taking into consideration the peculiar characters and habits of the different tribes of which the order is composed, I would suggest its distribution into four groups, of equal rank; namely, 1. Cursoria, legs formed for running—Blatta; 2. Raptoria, fore legs raptorial—Mantis, 3. Ambulatoria, legs formed for walking — Phasma; 4. Saltatoria, legs formed for leaping — Gryllus *Linn.* Of these groups the Cursoria are certainly most nearly allied to the Forficulidæ, both in their general structure and habits.

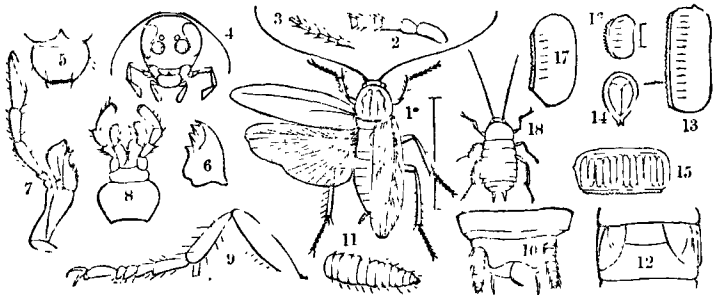
The first section, CURSORIA, comprises the single family BLATTIDÆ *Steph.*, and corresponds with the Linnæan genus Blatta, and the

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* BIBLIOGR. REFER. TO THE BLATTIDÆ.

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Rambur. Faune de l'Andalousie, No. 2.
Charpentier. Horæ Entomologicæ.

Fig. 51.



order Dictyoptera of Leach; the species of which are too well known under the ordinary name of cockroaches or black-beetles, although perfectly distinct from the order of beetles (Coleoptera), being distinguished by the structure of their wings, metamorphoses, &c. The body is broadly ovate and depressed (*fig.* 51. 1. Blatta germanica). The fore wings (tegmina) are coriaceous, veined, with the inner margin of one folding over the same margin of the other when at rest*; the posterior wings are longitudinally folded, except the anterior third part of the wing, which lies flat; the prothorax is large and shield-shaped, often completely concealing the head (*fig.* 51. 4. head of B. orientalis); the antennæ are very long, setaceous, and multi-articulate, from 50 to 150 joints (*fig.* 51. 2. basal, 51. 3. terminal joints of antennæ); the mandibles are short, but strong, horny, and toothed at the tip, and on the inner surface (*fig.* 51. 6.); the upper lip is entire (*fig.* 51. 5.); the maxillary palpi are elongated, with the last joint somewhat hatchet-shaped (*fig.* 51. 7.); the labium is bifid, with two more slender internal lobes (*fig.* 51. 8.); the eyes are kidney-shaped

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MacLeay. App. King's Voyage.
Nov. Mém. Soc. Roy. Danemarck, t. ii. Nov. Act. Nat. Curios. t. ii.
Brullé. Exped. Scient. de Morée.
Dryander. Cat. Libr. Banks, sub Blatta.
Drury, Palisot Beauvois, De Geer, Kirby (Century), *Perty* (Delect. An. art. Bras.), *Hummell* (Obs. Ent.).

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* The covered part is coloured less deeply than the rest of the wing-cover. Sometimes, as in Blatta (Corydia) Petiverana, the left wing-cover is ornamented with a coloured spot, which is not found in the opposite wing-cover; thus apparently destroying the symmetry of the insect's appearance; but when the wing-covers are closed, this spot is found to occupy the centre of the back.

(the antennæ being inserted in the notch on the inside); the ocelli obsolete; the legs are long and compressed (*fig.* 51. 9.), well formed for running, the tibiæ being armed with numerous strong, movable spines, and with apical spurs; and the tarsi of all the legs being 5-jointed, the basal joints not being furnished with cushions beneath (as in crawling insects); the terminal ungues are strong, between which there is a pulvillus; the abdomen is furnished at the tip with two short, conical, compressed, articulated appendages (*fig.* 51. 11.), which exist in both sexes; besides which, in the males, there is also a pair of slender, external, inarticulated appendages (sometimes these are difficult to be observed; so that M. Hummell denies their existence in the males of B. germanica), as well as an elongated, horny, intermediate one, which is recurved at the tip, and occasionally retracted within the abdomen (*fig.* 51. 10. ♂).

The males are distinguished by being smaller, and of a more slender form, and having eight ventral abdominal segments; whilst there are only six or seven ventral segments in the females, the terminal segment in the latter being occasionally keeled. In this sex the abdomen is much broader and larger than in the males. The sexes also differ in the developement of the wings. In B. orientalis the males have short tegmina and wings, not covering more than two thirds of the abdomen; whilst in the female the tegmina are very small, having a wide space between them, not extending beyond the metathorax (*fig.* 51. 12.), and the wings entirely obsolete. Brullé says that De Geer and Geoffroy have regarded the pupa of this species as the mature female; but this is evidently an error, as the individuals which these authors have figured as the female precisely agree with the individuals which are to be found carrying their capsules of eggs about with them, and in which there are no rudiments of posterior wings. Do these females ever acquire larger rudimental wing-covers?

In Blatta nigripes, the males have fully developed tegmina and wings; but in the females the tegmina cover about half the abdomen, slightly folding over each other; but the wings are also wanting. In B. lapponica, the male and female of which are well figured by De Geer, 3. t. xxv. f. 9, 10., the tegmina and wings, both of the males and females, are developed; but those of the latter do not quite cover the larger abdomen. In B. germanica, the tegmina of the female cover the abdomen, except at the sides, owing to its greater breadth.

These insects were well known to the ancients, who named them

Lucifuga, on account of their shunning the light. The insects which they named Blattæ were quite distinct, although it is impossible to decide what they really were.

These insects are extremely numerous, both as to numbers of species and of individuals, and are apparently distributed over every part of the globe; the majority are, however, still undescribed, an apparent distaste prevailing against them, evidently in consequence of their obnoxious qualities. The largest species (some of which exceed six inches in the expanse of their wings) are inhabitants of the tropics; but those which are aboriginal natives of our own country are of small size; the common domestic species, Blatta orientalis, being generally supposed to be a native of India*, and to have been imported through the aid of commerce, although it has been long domesticated with us, and was probably first imported from the Levant.† It does not, however, appear to have reached Sweden until about a century ago (1734 or 1739). From our increased communication with America, another larger species, supposed to be a native of that continent, is now in the course of introduction amongst us, and is found in situations in London where merchandise is stored. I have observed it swarming in a vessel recently arrived from the East Indies and the Mauritius; and M. Brullé states that this species is extremely injurious in the Isle of Bourbon. It is owing to the constant supply of food which they obtain amongst merchandise, &c., that they thus attend the footsteps of commerce, and it is in consequence of this that these insects abound in maritime commercial towns to the greatest extent.‡ They are nocturnal in their habits, hiding themselves during the day in holes and crevices, behind the wainscot of rooms, &c. They also appear to be fond of heat, being generally found in the greatest profusion near the fireplaces, and especially harbouring about bakers' ovens, where they have the additional inducement of a constant supply of crumbs and other food. They also

* Brullé, however, observes, "Par suite de ces migrations continuelles, il est quelques espèces dont le pays natal est devenu un problème, les noms qu'elles portent, tels que ceux de Blatte orientale, Blatte d'Amérique, &c., ne leur conviennent plus réellement, et ne leur ont été donnés que sur des renseignemens d'une exactitude fort douteuse." (*Hist. Nat. Ins.* tom. ix. p. 33.)

† "In Philippo navi quam nobilissimus ille alter Neptunus (Dracum equitem intelligo) aromatibus onustam vi cepit, ingens blattarum alatarum multitudo inveniebatur." (Mouffet, *Theatr. Ins.* p. 138.)

‡ Fifty years ago, the cockroach was recorded as a new importation at Selbourne (fifty miles from London), by Gilbert White.

devour flour, bread, meat, cheese (Lewis, *Trans. Ent. Soc.* vol i. p. lxxix.), woollen clothes, and even shoes. (*Linn. Amœn. Acad.* vol. iii. p. 345.; and Hummell, p. 14.) It does not appear that they devour each other, although Hummell states that the larvæ and pupæ will eat both exuviæ and the interior of the capsules. They also eject a dark-coloured fluid from the mouth, which emits a very disagreeable odour, which it is difficult to get rid of, and which also attaches to whatever they creep over. The ravages of these insects on board ships is so great, that barrels of rice, corn, or other provisions are at times completely destroyed by them*; and, in calm weather it is not unusual to employ the boys on board in collecting them at a small trifle per score. Various plans have been suggested for their destruction, but the most serviceable method is to use a small wooden box, having a circular hole at the top fitted with a glass rim, out of which it is impossible for them to escape. It should be nightly baited, and the contents thrown the next morning into scalding water.

It is, however, in the tropics that the ravages of these creatures are the most extensive, of which Drury has given us an account. They devour all kinds of victuals, dressed and undressed, and damage all sorts of clothing, leather, books, paper, &c., which if they do not destroy, at least they soil, as they frequently deposit a drop of their excrement where they settle. They swarm by myriads in old houses, making every part filthy beyond description. They have also the power of making a noise like a sharp knocking with the knuckle upon the wainscoting; Blatta gigantea being thence known in the West Indies by the name of drummer; and this they keep up, replying to each other, throughout the night; moreover, they attack sleeping persons, and will even eat the extremities of the dead. (Drury, *Ill. Exot. Ent.* vol. ii. p. 71. 2d ed.) †

According to M. Doumèrc, who had observed the habits of these insects in Brazil, those species which have the abdomen depressed, constituting the genus Phoraspis, are found upon plants in blossom, as

* Chamisso (*Verhandl. Gesellsch. Naturforsch. Fr.* in Berlin, b. i. st. iii. 1821, p. 174.

† The habits of the West Indian species are recorded in the *Mag. Nat. Hist.*, No. 27.; the *Annales Soc. Ent. de France*, 1837, p. 506.; and by Mr. Sells in the *Trans. Ent. Soc. London*, vol. i. p. xlviii. The annoyances produced by them on board ship are set forth by Mr. Lewis in the same volume, p. lxxix.

the sugar-cane, Zea Mays, &c., and are diurnal; whilst those which have the abdomen thick are nocturnal. (*Ann. Soc. Ent. France*, 1837, p. 46.)

Blatta lapponica of Linnæus is stated by that author to swarm in the huts of the Laplanders, and occasionally to devour, in conjunction with Silpha lapponica, the whole supply of dried fish in a day. There is some doubt as to the precise species thus named, as that which is considered by British entomologists as the B. lapponica (Curtis, pl. 556., Steph. *Ill.* pl. 28. f. 7.) is different in its habits, and is thence probably not identical with the Linnæan insect. The English species, as well as the other indigenous Blattidæ, are out-of-door insects. Thus, Curtis states that the English B. lapponica is sometimes abundant in the New Forest, on the fern, where he had taken it on the wing; and that it occurs near Reading, on white thorns. B. Panzeri and livida are found in the neighbourhood of the coast, under stones on the beach, and upon junci; and Stephens states that B. livida occurs beneath the bark of trees; and I found the males of B. nigripes on rushes at Blackgang Chine. It is on this account that I have proposed for these species the generic name of Ectobia, adopted by Stephens. (*Ill. B. E.* 6. 45.)

The late Dr. Heinecken published some observations in the *Zoological Journal*, No. 16., proving that these insects have the power of reproducing their antennæ to a certain extent when cut off near the base at an early stage of their growth; the increase taking place at the period of subsequent moulting.

These insects are, moreover, peculiarly interesting on account of their remarkable mode of oviposition. Instead of being discharged separately, the eggs are collected together, and deposited at once, enclosed in a large horny case, or capsule (equalling half the abdomen of the female), and variable in form in the different species, but generally of a more or less oval and somewhat compressed form, like a small bean, one of the edges being more compressed than the other. In this part there is a longitudinal slit in the capsule, each side of the slit being defended by a narrow and serrated plate, which fit closely against each other. The interior of this capsule is divided into two spaces, in each of which is a row of separate chambers, each chamber enclosing an egg; the number of the latter, according to Mr. Sells, corresponding with the number of serrations of the slit. The common cockroach may occasionally be seen running about with the egg capsule protruded from the extremity of the body; and (according to De Geer and Frisch)

the operation of oviposition occupies a week. Bl. germanica, according to Hummel, carries its capsule about with it for the space of a fortnight at least. Mr. Curtis states that it is retained in its situation until a convenient place is found for its reception by the *forceps* of the female; but the insect is furnished with no such instrument, it being the tightness of the membranes extending between the apical pieces of the body, that the capsule is thus retained. The capsules are attached by means of a glutinous secretion, in such situations as the females select as most fit for their reception. The slit part of the capsule is strongly coated with cement, so as to be even stronger than the other parts. In this capsule, the young larvæ are hatched, and immediately discharge a fluid which softens the cement and enables them to push open the slit through which they escape, after which the slit shuts again so closely, that it appears as entire as before. (Goeze in *Naturforscher*, st. 17.; Fraula *Mém. Bruxell.* t. iii. p. 219.; Frisch. *Beschr*, v. t. iii.)

In B. orientalis the length of the capsule (*fig.* 51. 17.) is not quite twice that of its breadth (five lines long by two and three quarters lines wide, and two lines thick): its sides are very convex, with eight impressions of each side*, thus indicating sixteen eggs. In the capsule of another species, given to me by W. Baird, Esq., by whom it was found on board of vessels coming from China, and which I have no hesitation in regarding as that of B. americana, the length is greater, and the edges nearly straight and parallel (six lines long by three lines wide, and one and three quarters lines thick), with about fifteen impressions on each side, indicating thirty eggs (*fig.* 51. 13.; 51. 14. transverse, 51. 15. longitudinal, section of the same).

I discovered numerous specimens of one of our small native species, Ectobia nigripes, in spots clothed with rushes, heath, and grass, at Black-gang Chine. The males were generally found by sweeping the sedges and rushes; but the females by disturbing the heath near the roots, when they start out and run with the greatest quickness. One of the females was in the act of carrying her capsule attached to the extremity of the abdomen. This capsule (*fig.* 51. 16.) is more kidney-shaped than those described above: it is a line and a half

* In the *Faune Française Orthopt.* pl. 2. the capsule of B. orientalis is figured without impressions. My description is made from a capsule still remaining attached to the abdomen of the female of that species. In the same plate, the capsules of B. lapponica are longitudinally compressed; which, I think, must be equally incorrect.

long, and about a line broad, and very convex, with about seven very slight transverse impressions. The manner in which the eggs are arranged by the female, the nature of the common envelope, the cause of its being so long borne about by the parent, &c., are points worthy of investigation. It appears, also, that each female only deposits one of these capsules, and that six months are requisite for the attainment of the perfect state; so that there can be but two broods in a year; nevertheless, in the B. orientalis, at least, there is no fixed time for oviposition, as the insects may be found in all their states in every part of the year.

Of the growth of the young Blattæ, and their gradual developement, a very interesting memoir has been published by M. Hummel (*Quelques Observations sur la Blatte Germanique*, in his "*Essais Entomologiques*," No. 1. St. Petersburg, 1821). This species, figured by Kirby and Spence, pl. 2. fig. 3., appears to be an introduced insect, being confined to dwellings and warehouses, occurring also in merchant vessels; Stephens says it is found about and in London, Portsmouth, and Plymouth, and that it is a presumed inhabitant of the woods of India. Several specimens were, however, taken by Mr. Gray of Dudley (to whom I am indebted for this species), in his garden, at the foot of the Castle Hill. I have received it from Van Diemen's Land, and have captured it on board vessels arrived from India. In Russia, where it is also found in houses in great numbers, it is called the Prussian, being supposed to have been imported with the Russian army on their return from Germany after the seven years' war, not having been previously noticed.

The capsule of this species is of an oblong form, subconvex, rounded at the sides and ends, with transverse lateral impressions, three lines long, and half that breadth. On introducing one of these capsules into a glass, in which a female B. germinaca was contained, the insect seized it with its fore legs, and made a longitudinal slit from end to end*, by which means the enclosed larvæ were set at liberty, making their appearance attached together by membrane in pairs, as they had been arranged within the capsule; the female then assisted them in detaching themselves. The number of larvæ thus produced was thirty-six: they were at first white and transparent, with only the eyes

* M. Hummel supposes that this capsule had been "jeté à l'instant même par quelque autre femelle;" but this could hardly have been the case, because the young were in a state ready to make their escape at the time.

black, but soon assumed a darker colour. The insect changes its skin six times before arriving at perfection. Three of the specimens, carefully observed, offered the following periods of the various moults: —

	First Larva.	Second Larva.	Third Larva.
Born,	1 April.	1 April.	1 April.
1st moult,	8 April.	8 April.	8 April.
2d	18 April.	20 April.	23 April.
3d	30 April.	1 May.	21 May.
4th	27 May.	7 June.	1 July.
5th	28 June.	6 July.	24 July.
6th	24 July	2 August	8 September.

Thus making seven weeks' difference in the arrival at the perfect state, although the insects were from the same capsule, all females, and all subjected to the same treatment. At the third moult the meso- and meta-thorax had increased in size, and still more visibly after the fourth; after the fifth the insect is in the pupa state: the prothorax has attained its full size during this period. "Peu-à-peu les fourreaux des ailes (les deux anneaux susmentionnés) se séparent et s'étendent." (*Hummel, Op. Cit.* p. 9.) In a communication published in the *Field Naturalist*, p. 129., it is stated that, during the time of moulting, the insect is assisted in disengaging itself from its old skin by its companions. The larvæ of Blatta are moderately long, flattened, and narrowed in front (*fig.* 51. 18.); those of Polyphaga are short, convex, and nearly hemispherical; with the legs short, and the tibiæ slender and armed with strong spines. The larvæ of the Blaberi resemble the Molluscous Oscabrions, being of an oval and rounded form, very convex, with a broad margin; those of Panesthia have the surface of the thorax irregular, as in the perfect insect. Generally, the larvæ are ornamented with spots of red or buff, which disappear on their arrival at the perfect state.

These insects are subject to the attacks of various parasites. In the Isle of Bourbon, a species of Sphex provisions its nest with the Bl. americana, which it wounds with its sting, so as to render it immovable, and then deposits in the nest it had prepared, and upon which its future progeny subsist. The species of the genus Evania also appear to be attached to these insects; Kirby and Spence stating, on the authority of Dr. Arnold, that they are parasitic upon them. Mr. MacLeay, however, informs me that it is upon the capsule of eggs that the Evania subsists. Evania minuta is found upon Parley Heath, Dorset, where Blatta

lapponica abounds; and, as these insects are found in company together, it has been conjectured that the former is the parasite of the latter. (Curtis, *B. E.* 257.) I have received an Evania, apparently identical with E. appendigaster, from Mr. R. H. Lewis, with the observation, "Taken at sea, parasitic on a large Blatta, which infests ships." I have also received from Mr. W. Baird specimens of a small species of Eulophus (with simple antennæ in both sexes), of which about seventy individuals burst forth from a capsule of Blatta americana, in which the eggs of the parasite must have been deposited during the voyage.* In a preceding species, I have given an account of a Coleopterous insect, which is also parasitic on the Blattæ (Symbius Blattarum). (*Vide ante*, p. 295.) The house-cricket is also said to be one of its enemies; but, according to Gilbert White, there seems to be no real reason for the statement. There are also several species of birds which greedily devour the cockroaches; and the common hedgehog is often kept in confinement for the purpose of destroying them. Simia Jacchus *Linn.* will also feed on them in default of fruit. (*Mag. Nat. Hist.* vol. i. p. 16.)

M. Bérendt has published a memoir on the species "des Blattes antédiluviennes," observed by him in yellow amber. (*Ann. Soc. Ent. France*, 1836, p. 539. pl. 16.)

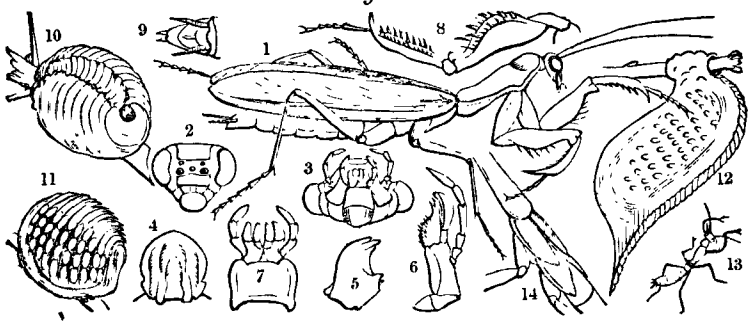
Latreille divided these insects into two genera; those with perfect wings, and those in which one sex at least "est privée d'ailes, telles que la B. orientalis" (*R. An.* tom. v. p. 175.), forming the latter into the genus Kakerlac, which is the name given to these insects in the French colonies. From the barbarous nature of this name, Fischer has rejected it, proposing that of Steleopyga in its stead. Serville, in his review of the order, has divided the family into eight genera, adopting that of Latreille's Kakerlac, and giving the small indigenous species under the generic name of Blatta; but, as the Blatta orientalis ought evidently to be retained as the type of the genus Blatta, I have considered the names of Kakerlac and Steleopyga as synonyms, and have proposed another name for the small species.

Amongst the exotic genera are to be noticed Phoraspis, composed of Brazilian species, with a pale stripe down the wing-covers; Pseudomops, having the base of the antennæ strongly setose; and Perisphæria, having the body contracted into a ball.

* At the meeting of the Entomological Society, October 1st, 1838, Mr. Sells exhibited ninety-four specimens of a small Pteromalus, extracted from one capsule.

The second section, RAPTORIA, comprises the single family MANTIDÆ, a tribe of insects none of which are indigenous, being chiefly inhabitants of tropical countries, and which have received the name of soothsayers, from their curious motions, as well as camel crickets,

Fig. 52.



from the great length of the neck (*fig.* 52. 1. Mantis religiosa, South of Europe). The body is long and narrow, subcylindrical, with the head exposed, and the abdomen broader than the front of the body, and depressed. The head is not concealed beneath the thoracic shield, as in the Blattæ: it is vertical, with the face (*fig.* 52. 2., 52. 3. under side of head) triangular; the eyes are large, and occupy the sides of the head; the ocelli, three in number, are placed

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Lefebvre, in Ann. Soc. Ent. France, tom. iv.
Obs. Phys. Méd. Acad. Natur. Curios. tom. ii. and iii.
MacLeay. App. King's Voyage.
Palisot Beauvois, Drury, Kirby (Century), *Brullé* (Morea), *Fabricius, Olivier.*

in a triangle in the middle of the forehead, between the eyes, and behind the antennæ: they are much more distinct, and larger, in the males that in the females. The upper lip is broadly ovate and entire (*fig.* 52. 4., under side); the mandibles (*fig.* 52. 5.) trigonate, horny, with two or three acute teeth at the tips, and a strong tooth below the middle of the inner margin; the maxillæ (*fig.* 52. 6.) are long, the outer lobe galeiform, and the inner with two acute teeth at the tip; the maxillary palpi are 5-jointed, filiform, terminating in a point, and reaching but little beyond the tips of the maxillæ; the mentum is leathery, subquadrate; the labium (*fig.* 52. 7.), distinctly divided into four equal-sized lobes, articulated about the middle; the labial palpi are short, filiform, and 3-jointed. The antennæ are inserted between the eyes, and generally slender and filiform: in some (Empusa) they are bipectinated in the males, and short in the females. The anterior part of the thorax is greatly elongated into a narrow neck*, rather dilated in front, at which part, on the under side, the fore legs are attached, leaving a long, flat, narrow space on the under side behind these legs: the remainder of the thorax is short, concealed by the tegmina and wings when closed, and without any prominent scutellum. The abdomen is long, and depressed, with nine dorsal segments in both sexes, but with six ventral segments in the female, and eight in the male, terminated by two articulated appendages, as in the Blattæ: besides which, in the male, there is a pair of apical, inarticulated, short filaments† (*fig.* 52. 9.). The females are also distinguished by the large size of the terminal segment, preceded by equal-sized segments; whereas the terminal segment is very small in the males. The upper wings are long, with numerous veins: they are carried horizontally upon the back when at rest, one greatly overlapping the other. The wings are large and numerously veined; the wing-covers of the males are nearly of the same consistence as their wings; they are also longer and narrower than in the females, and always more

* In some species, the sides are furnished with singular flat leaf-like appendages, which give this part of the body a remarkable appearance.

From a comparative examination of Mantis and Phasma, I am inclined to regard the elongated anterior part of the thorax as composed of the prothorax and an elongated anterior part of the mesothorax, at least, on the under surface, rather than as entirely prothoracic, as it has been ordinarily regarded.

† This is the case, at least, in M. religiosa ♂, although the existence of these inarticulated filaments is denied by Brullé; and see Lefebvre in *Ann. Soc. Ent. France*, tom. iv. pl. 11. *fig.* 13. *a**.

transparent. In addition to the previously mentioned characters, the males are but little smaller than the females; they have longer antennæ, larger eyes, a narrower, smoother prothorax, longer fore legs, with the raptorial part more slender. Some species, however, figured by M. Rambur in his *Entomol. Fauna of Andalusia*, exhibit more decided sexual differences. In M. Boetica the male is much more slender, with a narrower head, than the female, which has wings and wing-covers not extending beyond half the abdomen; those of the male being as long as the abdomen; whilst in M. brevis the male is equally slender, with full-sized wings and wing-covers; but the female is short, very broad, and with mere rudiments of wing-covers.

The most characteristic parts of the insect, however, are the fore legs (*fig.* 52. 8.), which are much larger than the others, and formed for seizing their prey; the coxæ are very long, the trochanters short and triangular, the femora robust, compressed, curved on the under-side with a channel, armed at its edges with a double row of strong movable spines: this armed channel extends along the terminal half of the femur, there being one or several long teeth in the centre of the thigh. The tibiæ are short, horny, and curved, fitting into the channel on the under side of the femora, terminated in a long curved spine, and armed on the under side with shorter spines. The tarsi are slender, and 5-jointed, reaching with the tibiæ to the base of the femora. The posterior legs are long and slender, and formed for walking, with simple 5-jointed tarsi: sometimes these legs are furnished with a membranous dilatation of variable form.

The name given to these insects is Greek in its origin, and was evidently bestowed on them from their attenuated form. In one of the Idylls of Theocritus the word was employed to designate a thin, young girl, with slender, elongated arms: "Præmacram ac pretenuem puellam, *μαντιν*." (Griffith, *An. Kingd.* pt. 31. 188.)

These insects are found upon plants and trees, and their attitude, whilst lying in wait for their prey, which consists of other insects, is very singular. They sit for hours together stationary, with the front part of the thorax elevated, and with the fore legs held up together, like a pair of arms, prepared to seize any insect which may fall within their reach. It is hence that they have obtained a sort of sacred character amongst the Turks, Hottentots *, and other superstitious in-

* Sparrmann informs us that Mantis (Schizocephala) oculata is worshipped by the

habitants of the countries which they inhabit, and who, from a fanciful notion that the insects were engaged in prayer, have given them such names as Prega diou, or Prie-Dieu, as they are called in the South of France and Italy, and Louva Dios by the Portuguese; and hence the specific names of Mantis religiosa, precaria, sancta, oratoria, &c., have been applied to them. Their attitude, being that of begging, has also induced the application of such names as mendica, pauperata, superstitiosa. The monkish legends tell us that St. Francis Xavier seeing a mantis moving along in its solemn way, holding up its two fore legs as in the act of devotion, desired it to sing the praises of God; whereupon the insect carolled forth a fine canticle. (*Ins. Arch.* p. 63.) Mouffet, also, informs us that "so divine a creature is this esteemed, that if a childe aske the way to such a place, she will stretch out one of her feet and show him the right way, and seldom or never misse. As she resembleth those diviners in the elevation of her hands, so also in likenesse of motion; for they do not sport themselves as others do, nor leap, nor play; but, walking softly, she retains her modesty, and shows forth a kind of mature gravity." But this gravity has an object of a very different kind to that of the sorcerer. It is thus, after exhibiting a wonderful degree of patience, that, like a cat approaching a mouse, the mantis moves almost imperceptibly along, and steals towards its prey, fearful of putting it to flight. When sufficiently near, the fore leg is extended to its full length, and the insect seized, being immediately secured between the tibia and femur, where it is held by the numerous teeth with which those parts are armed.

These insects are, in fact, very voracious. Rösel (*Insect. Belustig.* vol. iv. pl. 12.) kept several for a long time, feeding them upon flies, the female devouring six in a day. When confined together, they fought violently, cutting at each other with their fore legs; and even the male occasionally fell a victim to the voracity of his partner. In the *Journal de Physique de Rozier* (1784, t. xxv. p. 334.), an instance is recorded, in which the female first cut off the head of her mate, after which coupling took place, which was followed by the female devouring the male. Rösel observes that, in their mutual conflicts, their manœuvres very much resemble those of hussars fighting with

Hottentots as a tutelary divinity; and, if it happen to alight on any person, he is at once considered as the peculiar favourite of Heaven, and looked up to as a saint. Latreille, also, notices a similar superstition in Cailliaud's voyage to Nubia.

sabres; and the Chinese, aware of their savage pugnacious propensities, keep these insects in little bamboo cages, and match them together in combats, as is done with fighting-cocks. (Barrow's *China.*) They are, however, as cowardly as barbarous; for the instant that Rösel introduced some ants amongst them, they endeavoured to escape in every direction.

The eggs, which are long and narrow, are arranged by the female in regular series, each egg being enclosed in a separate cell, and together forming a large oval or rounded mass, covered with a soft, whitish, gummy substance, which soon hardens, and assumes a yellowish colour. In the common M. oratoria, which, according to Rösel, is found chiefly in the vineyards of Germany, where it is named der wein handel, the mass of eggs is oblong, and is attached to sprigs of the vine.

In a large Himalayan species, observed by Professor Royle, and figured in his work on the botany of that country, the mass of eggs is oval, and the membranous secretion with which they are covered is very thick. My *fig.* 52. 12. represents the mass of eggs of a Brazilian mantis: it is attached to a twig at the base, and resembles a seed-pod, being of a green colour, and terminating in a long, acute point. The keeled part is white, but assumes a reddish colour towards the base. The outer coating is membranous, showing no appearance of threads: it is thin, and encloses a great number of eggs, arranged in transverse rows, and enclosed in a silk-like covering.* *Fig.* 52. 10. represents a smaller, nearly globular, mass of eggs, of a species from Bengal; *fig.* 52. 11. showing a transverse section of the same, and exhibiting about a dozen layers of the eggs, four or five being comprised in each layer.

The formation of the egg case takes place in the common European species in September; but the young are not hatched till the following June. As the eggs ripen, they are protruded through the thick substance of their envelope; and the larvæ burst forth out of them, having the form of their parent, but being destitute of wings (*fig.* 52. 13.). The larvæ change their skins several times, arriving at the perfect state in about three months. The pupa is distinguished by having the meso- and meta-thorax (*fig.* 52. 14.) provided with short cases, in which the rudimental wing-covers and wings are enclosed. (Savigny,

* See, also, Merian's *Surinam Ins.* p. 66.; and, for further details of the habits of the Blattidæ, Geoffroy, *Ins. Paris,* tom. i. p. 399.; De Geer, *Ins.* vol. iii. p. 399; Burchell's *Travels in South Africa;* Giorna, *Mem. Soc. Torino,* vol. i. (Empusa pectinicornis); Disderi in ditto, vol. iii. (Mantis religiosa).

Descript. de l'Egypte, Pl. Orthopt., copied in *Règne An.* edit. *Crochard. Ins.* pl. 10. f. 10.; and *De Geer*, vol. iii. pl. 36. f. 8.)

These insects are rather numerous in respect to species, being also generally of a large size: they are ordinarily handsomely ornamented in their colours, although green or grey are their prevailing tints*, corresponding with the situations in which they are found. They are distributed throughout the tropical regions of the world, but do not reach a more northern latitude than the middle of France M. Savigny, and, more recently, M. Al. Lefebvre, have figured some singular species (Eremiaphila *Lefebvre*), which inhabit the desert sandy plains of Egypt, where insects are but rarely found: their movements are very slow, and their colour resembles that of the sand upon which they are found.

I have received, both from Dr. Klug and M. V. Audouin, specimens of several species of Chalcidideous parasites, obtained by them from the eggs of Mauritian and Brazilian species of Mantidæ. These species appear to belong to a genus closely allied to Palmon of Dalman. It is probable that the eggs of the parasite are deposited before the glutinous covering has acquired its consistency. An anonymous writer in the *Entomol. Magazine* (vol. iii. p. 178.) has also noticed the occurrence of other Chalcidideous parasites in the eggs of Mantis religiosa, found by him in Cephalonia.

These insects were for a long time united with the Phasmidæ in the same genus. Lichtenstein, however, first systematically divided them, in the *Linn. Trans.* vol. vi.; although Stoll had previously pointed out their distinction; the diversity of their habits being sufficient to warrant their separation into distinct families. They were retained by Latreille under the single genus Mantis; those with pectinated antennæ (Empusa *Ill.*) forming a section. M. Serville, however, divided them into eleven genera in his *Révue Méthodique;* and M. Al. Lefebvre has added two others in his memoir on Erimiaphila, noticed above. Of these genera, Heteronytarsus *Lefeb.* is remarkable in having only four joints in the two anterior, three joints in the four posterior, tarsi. In Empusa, the head is produced above into a long leaf-like appendage; the four posterior thighs are furnished

* In the sand-coloured Eremiaphilæ, the under side of the wing-covers is ornamented with a brilliant metallic-coloured spot; but in my genus Metallyticus the entire insect is of a splendid metallic golden green, varying to copper, and whilst some specimens are brilliant chalybeous.

with a lateral membrane. In several of the genera, the eyes terminate in an acute point. Cheradodes, Hymenopus, &c., and an extraordinary species from Malacca (Deroplatys desiccata *Westw.*), have the prothorax, or thighs, furnished with large flat membranes. The genus Toxodera of Serville seems to connect this family with the Phasmidæ, the abdomen being furnished with dorsal plates and apical folioles, as in some species of the latter family.

The third section, AMBULATORIA, comprises the single family PHASMIDÆ*, a tribe of exotic insects of the most extraordinary forms, long united in the same family with the Mantidæ, but from which they are at once distinguished by the fore legs being of the ordinary form, and fitted, like the rest, for walking rather than running, as in the Blattidæ. From the remaining Orthopterous insects they are distinguished by the hind legs not being saltatorial.

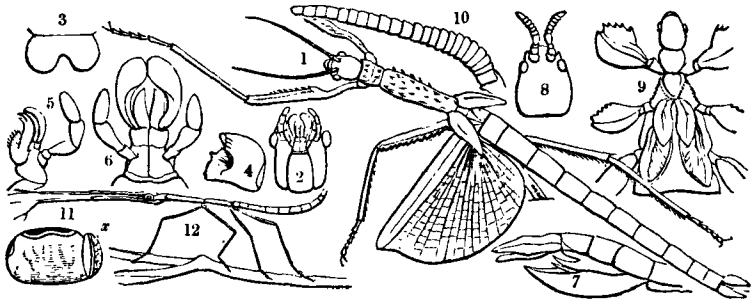
The body is generally long and slender (*fig.* 53. 1. Phasma (Diura) Japetus *G. R. Gray*, New Holland, reduced to about half the natural length). The head is of moderate size, of an oval, subdepressed form (*fig.* 53. 2.), porrected, with large globular eyes, in front of which the antennæ are placed, which are variable in form, but ordinarily long, slender, and composed of a great number of articulations. The

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* BIBLIOGR. REFER. TO THE PHASMIDÆ.

Stoll. Representation des Spectres, &c.
Lichtenstein. Trans. Linn. Soc. Lond. vol. vi.
Parkinson, in Trans. Linn. Soc. Lond. vol. iv. (Phasma dilatatum).
Serville, in Ann. Sc. Nat. tom. xxii.
Saint Fargeau and *Serville,* in Encyclop. Méthodique, tom. x.
Gray. Monograph. of G. Phasma (Entom. of Australia, part i.), 4to. 1833. — Ditto, Synopsis of Phasmidæ, 8vo. Lond. 1835. — Ditto, in Mag. Nat. Hist. new series, No. 3. — Ditto, in Trans. Ent. Soc. vol. i.
Boisduval. Voy. de l'Astrolabe.
Leach, in Risso Hist. Europ. Merid. (Phantoma).
Guilding, in Trans. Linn. Soc. vol. xiv. (Phasma cornutum).
Brullé. Exped. Scient. Morée.
Westwood, in Zool. Journ. (Aschiphasma, Perlamorpha *Curt*).
Donovan. Insects of India.

Fig. 53.



ocelli are rudimental, or entirely obsolete. This is not only the case in the larvæ and wingless species, but also in some furnished with wings; in others, however (even closely allied to the foregoing), the ocelli exist between the eyes in a triangle*; the labrum is deeply notched in front (*fig.* 53. 3.); the jaws (*fig.* 53. 4.) are strong and horny, either entire at the tips, with several notches towards the base of the internal margin, or deeply excavated on the inner edge, with the margins toothed; the maxillæ (*fig.* 53. 5.) and labium (*fig.* 53. 6.) are formed as in the Mantidæ; but the palpi are broader and compressed; the internal labial lobes are shorter than the external†; the prothorax is small, not dilated at the sides, and narrower than the head; the mesothorax, as well as the metathorax (in the winged species), is greatly elongated, being occasionally as long as the abdomen, which is also generally long and narrow; but in the Phylliides broad and depressed. Its extremity is destitute of the articulated filaments of the Mantidæ, which are replaced by two inarticulated plates of variable form, serving in the females for the deposition of the eggs, and which, in the Australian species, acquire a great length (*fig.* 53. 7. extremity of body of P. (D.) Titan ♀, New Holland).

The separation between the terminal thoracic and abdominal seg-

* The absence or presence of ocelli has been adopted as one of the chief characters for dividing the Phasmidæ into groups; but, from my own observations, I have little doubt that their existence in this section is sexual, the males only possessing them. (See Gray, in *Mag. Nat. Hist.* new series, vol. i. p. 144.)

† These details of the mouth, together with *fig.* 53. 2., representing the under side of the head, are taken from a fine, large, undescribed insect in my collection (allied to P. dilatatum *Shaw*), being five and a half inches long.

ments is so slight, that entomologists have fallen into error respecting it. Thus, in the winged individuals, the abdomen is stated by Brullé to have ten dorsal segments; whilst in the wingless species, and in the larvæ, there are but nine dorsal segments; but an attentive comparison between the more regularly developed metathorax of the latter with the metathorax and supposed basal abdominal segment of the former, clearly proves that the two last-mentioned segments are but one segment, of which the anterior portion is more developed, in order to give support to the wings, which are attached to it in front. The dorsal surface of the abdomen, thus, in the individuals of both sexes, consists of nine segments; but on the ventral surface the three terminal segments are represented in the females by a single plate, serving as a kind of ovipositor; thus, in the males, there are nine, whilst in the females there are only seven, distinct ventral segments.

All the legs are alike, being long and slender, often armed with short spurs along the edges. The coxa* is of small size, and the tarsi are simple and 5-jointed†, with the under side of the joints clothed with a membranous cushion, enabling them to retain their situation upon plants; the pulvillus between the ungues is also large. In some species the femora are furnished with large, membranous, flattened appendages; and in many the base of the anterior femora is curved so as to fit the head. This peculiarity is rendered necessary by the habit of the insect when at rest, in stretching its legs forward in a straight line, so as to defend the antennæ. This is the position in which L. Guilding represented the larva of P. cornutum. (*Linn. Trans.* vol. xiv. pl. 7. See my *fig.* 53. 12.)

The tegmina, or fore wings, are of small size‡, and, when present, are attached at the posterior part of the mesothorax. The true wings, on the other hand, are very large, and attached to the anterior part of the metathorax. As they far exceed the wing-covers in size, it is essential that provision should be made for their defence. This

* The elongation of the coxæ is one of the surest indications of predaceous habits, giving to the leg a greatly increased degree of action.

† Percheron describes Bacteria rosaria as having only four joints in the tarsi; and I possess a large apterous species, in which the anterior tarsi are only 4-jointed, the others bein 5-jointed.

‡ In a preceding page, I have noticed the occurrence of a species belonging to this family, in which the fore wings are entirely obsolete, whilst the hind wings are of large size.

is effected, not, as in the earwig, by the transverse folding of the wing, so as to enable it to be folded beneath the small wing-cover, but by the front margin of the hind wing being greatly thickened, serving as a flat plate, beneath which the other part of the wing is folded longitudinally; the latter part being often differently coloured. Thus, in some species the short wing-covers and the front margin of the wing are pale green, whilst the other part of the wing is pink. Many species, however, remain throughout their lives without ever acquiring wings or wing-covers.

In addition to the sexual differences in the number of the abdominal segments, above-mentioned, the males are generally longer and more slender, with the abdomen broader at the tip, and with shorter wing-covers, longer wings, and more slender antennæ.

The internal anatomy of Phasma (Bacteria) arumatia has formed the subject of a very elaborate memoir by Dr. Müller, in the *Nova Acta Naturæ Curiosorum*, vol. xii. par. 2., and which has been reviewed in the 3d volume of the *Zoological Journal.*

The ordinary names of walkingsticks, straws, or leaves, spectres, &c., and the systematic names of Phasma and Phyllium, have been given to these insects, from their singular resemblance to vegetable structures "in their form, substance, and vascular texture; some representing green leaves, and others those that are dry and withered: nay, sometimes this mimicry is so exquisite, that you would mistake the whole insect for a portion of the branching spray of a tree." (*Kirby and Spence.*) Hence it is not to be wondered at, that fanciful authors should have been induced to regard these creatures as exhibiting an identity of animal and vegetable development. Thus Bradley, although a F.R.S., described and figured two species of Folium ambulans (as he termed these walking-leaf Phasmidæ), and informs us that the insect is hatched from eggs deposited in the buds of trees at the time that the buds begin to shoot. "The insect is then nourished by the juices of the tree, and grows together with the leaves till all its body is perfected; and at the fall of the leaf drops from the tree, with the leaves growing to its body like wings, and then walks about*;" after which follow divers specula-

* *New Improvements of Planting and Gardening*, 1718, part 3. p. 77, 78. Ditto, *Philosoph. Account of the Works of Nature*, 1739, p. 212. This is the same author who gravely recorded the transformation of moths into bees, figuring the humming bird hawk-moth, and the bee-sphinxes, as the intermediate stages! (See Haworth, in *Entomol. Trans.* 1807, p. 25.)

tions on the mode in which the sap of the tree adapts itself to the maintenance at once both of vegetable and animal life. Other species bear a far greater resemblance to dead twigs, the legs being generally extended in a straight line, looking like the lateral twigs; and as these insects ordinarily remain a long time immoveable upon the branches and amongst the leaves, the deception is greatly increased. Even in the species furnished with wings, these organs are laid flat along the back, so as not to extend beyond the body, and thus destroy the resemblance.

The whole structure of these insects indicates a sluggish mode of life: they subsist solely upon vegetables, mostly solitary, or in pairs, crawling slowly amongst the branches of low shrubs, and devouring the young glutinous or gummy shoots. Such is the account of the Australian species furnished to G. R. Gray by the late Allan Cunningham, the lamented botanist: and Titian R. Peale found an American species (Anisomorpha buprestoides *Say, American Ent.* vol. iii. pl. 38.), having similar habits, upon the leaves of the palmetto; being generally in pairs, and lying close to the rib of the leaf. When taken, they discharged a milky fluid from two pores of the thorax, diffusing a strong odour, resembling that of Gnaphalium; and, as that plant was growing near the place where they occurred, it is conjectured that it formed at least part of their food. G. R. Gray notices, on the authority of Dr. Harlan, that the female of an American species had been observed to eat off the head of its companion while in the excitement of their mutual amours; but Brullé suggests that this observation must rather have applied to one of the Mantidæ. Mr. Nightingale states that a large species of Phasma is very destructive in the Bara Tonga islands, feeding on the cocoa-nut (the chief support of the inhabitants); so that orders are issued by the chiefs for their destruction. (*Trans. Ent. Soc.* vol. i. p. 63.) The late Rev. L. Guilding observed the economy of P. (Bacteria) cornutum in the West Indies, of which he published an account, with figures, in the 14th volume of the *Linn. Trans.* This is one of the apterous species, and there is a great diversity in the size of the sexes; the male being $3\frac{3}{4}$ inches long, whilst the female is $7\frac{1}{3}$. It is very abundant in tropical America and the adjacent islands, feeding by night upon the leaves, which it greedily consumes. It walks with a very vacillating motion; and, when resting, extends its fore legs along the head, so as to defend the

antennæ. It is tenacious of life. It occurs in the imago state throughout the year; coupling in May and June. The female deposits twenty-two eggs from September to November. These eggs are oval, and greatly resemble a leguminous seed, having numerous scattered impressed dots, and an elongated lateral chain-like spot. The operculum at one end is distinct, and impressed like a honeycomb. The eggs are retained a long time in the ovipositor at the extremity of the abdomen before they are relinquished by the parent insect, which rejects them without any attention: according to Stoll, the eggs are deposited in the earth like those of the locusts. The egg state continues from seventy-nine to one hundred days; the larva is hatched from May to August. The young larva has all the appearance of the imago, but differs in its colours. After throwing off its first exuviæ, it grows rapidly until the horns of the head appear. If it lose a leg by violence, this is reproduced, but of a smaller size, on the next moulting. The pupa scarcely differs in any respect from the imago.

Various additional instances of the growth of legs, when accidentally broken off, are given by Gray (*Mag. Nat. Hist.*, N. S., vol. i. p. 144.), and by Brullé (*Hist. Nat. Ins.* vol. ix. p. 84.).

The eggs of the Phasmidæ are of large size, and the operculum at the end is separated from the rest of the egg by a smooth edge, which it exactly fits (*fig.* 53. 11., egg of Ph. cornutum *Guilding*). The sides of the egg are ornamented with various sinuous lines, which, in Phasma dilatatum (Parkinson, *Linn. Trans.* vol. iv. pl. 18.), form a 4-rayed star. The egg of Aschiphasma hieroglyphica resembles a small flat cherry-stone, having a double ridge running round it.

In the larva state (*fig.* 53. 12., larva of Ph. cornutum *Guilding*) these insects are distinguished by shorter, thicker legs, and by being destitute of wings, in which respect they much resemble the wingless species in the last state. The latter are, however, ordinarily to be known by the harder appearance of their integuments. The pupæ in the winged species have the rudimental wing-covers and wings short, and closely applied to the surface of the base of the abdomen (*fig.* 53. 9., front of body of ♂ pupa of Phyllium siccifolium). In their final state the wings are fully developed, as well as the ocelli, where present; and the legs are of a more slender and longer form. These insects are exclusively exotic, three species only being found in the south of Europe, and three in North America; upwards of forty have been

noticed as inhabitants of India, China, and the Malay Islands; twenty-nine South American, and twenty-seven Australian species: only two small apterous species have hitherto occurred in Africa. They may be regarded as amongst the most gigantic of the insect tribes, some of the Indian and Australian species being nearly, or even more than a foot long. They are not so much varied in their colours as the locusts, being generally brown, green, or grey; their wings are, however, often prettily coloured or spotted.

Various modes of arrangement have been proposed by Latreille, Serville, and Gray, founded upon the general form of the body, the presence or absence of ocelli or of wings; but as the species are entirely exotic, the discussion of the merits of these classifications may be here dispensed with.

Amongst these insects, the genus Phyllium of *Illiger*, comprising the walking-leaf insects above mentioned, is certainly the most extraordinary. The body is flat and very broad, and the legs are provided with leaf-like appendages. The antennæ of the males are half the length of the body, but those of the females are not half the length of the head, and only 9-jointed. The males are furnished with three ocelli, of which the females are destitute: the latter sex has large wing-covers nearly covering the abdomen, with strong oblique veins, which, when laid flat upon the back, have together the exact resemblance of a leaf; the wings, however, are wanting in this sex. The males, on the other hand, have very short wing-covers; but the wings are large, and extend to the extremity of the body: moreover, this sex is distinguished by two remarkable eye-like spots on the fourth segment of the abdomen. These insects are of great rarity, and inhabit the East Indies. Donovan has figured the female, together with the female pupa, in his *Insects of India*, pl. 11. (new ed.); and in the new edition (Crochard's) of the *Règne Animal*, numerous details are given of it; but the insect figured as the male imago is only a pupa. The perfect male of one of the species of Phyllium is given in Griffith's *Animal Kingdom, Insects*, pl. 63. fig. 3. *Fig.* 58. 8. represents the head of the female; 53. 9. the front of body of the male pupa; 58. 10. the antenna of the male pupa.

The fourth section, SALTATORIA *, corresponds with the Linnæan genus Gryllus, and consists of all those species which have the four anterior legs simple and short, and the two hind legs long and formed for leaping. For this purpose the femora are greatly thickened, so as internally to afford support to the strong muscles by which the leap is effected; the posterior edge of the thigh is channelled, so as to receive the tibia when at rest; the upper or posterior surface of the latter being generally strongly spined, and furnished at the tip with robust spurs, which assist greatly in effecting the leap of the insect, by offering resistance against the substance on which the insect is stationed. The body is generally compressed; the tarsi vary in the number of their joints, as well as the antennæ, which are also greatly variable in length, being in some species several times longer than the body. The males are enabled to make a peculiar chirruping noise, which is produced in different manners in the different groups, being in some (Locusta) caused by the friction of the posterior femora against the wing-covers, and in the others by the friction of the strong veins enclosing a talc-like spot or crepitaculum, at the base of the wing-covers. In the latter species, the anterior tibiæ are provided at the base with a pair of oval foramina closed by membrane (Guilding, *Linn. Trans.* vol. 15., On the Crepitaculum and Foramina of some Orthopterous Insects). The females ordinarily deposit their eggs, by the assistance of a (generally exserted) horny oviposit[illegible], in the earth; and the species are almost exclusively herbivorous.

There has been much confusion and difference of opinion as to the

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* BIBLIOGR. REFER. TO THE SALTATORIAL ORTHOPTERA IN GENERAL.

Linnæus. Surinamensia Grylliana. 4to. Upsal, 1748. Amæn. Acad. t. i.

Collinson. De Gryllis Americæ Septentr. Phil. Trans. vol. liv.

Thunberg. Pneumora in Swed. Trans. 1775; and N. Sp. of ditto in ditto, 1810. Ditto. Descriptio Acridii, Nov. Act. Upsal, vol. vii. Ditto on Truxalis, in ditto, vol. ix. 1827. Ditto. Hemipt. Maxill. Genera, in Mém. Acad. St. Petersburg, tom. v. Ditto. Grylli Monogr. Illust. in ditto, tom. ix. 1824 (containing 106 species, of which 66 are new).

Rembold. Historisch und Ph. Tract. von Heuschrecken. 8vo. Berl. Leipz. 1730, 1 pl.

Kirby. On Nomenclature of Gryllina (Zool. Journ. vol. i. and vol. ii.)

Serville's Revision of the Order above referred to.

Panzer, Rösel, Stoll, Palisot Beauvois, Drury, Donovan, De Geer, Fabricius, Petty (Del. An. art. Bras.).

nomenclature of the different groups of which this section is composed. Linnæus introduced five divisions into his genus Gryllus: 1. *Acrida*, with short ensiform antennæ (G. nasutus, &c.); 2. *Bulla*, with short filiform antennæ, and the thorax carinated (G. bipunctatus, &c.); 3. *Acheta*, with two anal setæ (the various species known under the English name of crickets*; G. domesticus, &c.); 4. *Tettigonia*, with an ensiform ovipositor, and long setaceous antennæ (G. viridissimus, &c.); and, 5. *Locusta*, with short filiform antennæ, and destitute of exserted ovipositor (G. migratorius, &c.) Notwithstanding the evident propriety of regarding the last-named insect, which is the migratory locust, as entitled to retain the name of Locusta, it is singular that not one of the Linnæan names has been retained by continental writers in the Linnæan sense. The Linnæan Acridæ and Bullæ naturally belong to the same section as the migratory locust; and thus there are three families formed, corresponding with the third, fourth, and fifth Linnæan divisions. Of the names of these three divisions, Acheta and Locusta ought unquestionably to be retained as the base of the family names of two of them; that of Tettigonia has, however, been applied to some of the Homoptera, and all subsequent writers reject it from the Orthoptera. In order, therefore, that the name Gryllus should not be lost, it will be advisable to apply it restrictedly to the Linnæan Tettigoniæ.† We thus obtain the three family names Achetidæ, Gryllidæ, and Locustidæ; in a sense, however, different from that in which they are ordinarily employed by the French entomologists. In order to clear up the confusion, Mr. Kirby published a memoir in the *Zoological Journal*, in which, however, he proposed to retain the Linnæan name of Acrida for our grasshoppers with long antennæ; a decidedly objectionable step, as the name, if employed at all, ought certainly to supersede that of Truxalis, which is now universally employed instead of the Linnæan name Acrida, which is consequently a synonym, and ought to be dropped. Moreover, as both the names Acrida and Acrydium are derived from the Greek ἀκρίς, which is precisely synonymous with the Latin name Locusta, it is evidently perpetuating confusion by retaining either of them. The Latin name is admirably expressive of the ravages of the migratory species, being evidently derived from the words *locus* and *ustus*; and thus we figura-

* The "criquets" of the French entomologists are the all-devastating locusts.

† Fabricius employed it for the locusts, instead of naming them Locusta, which name he gave to the Grylli Tettigoniæ of Linnæus.

tively read, "A fire devoureth before them, and behind them a flame burneth." (*Joel*, chap. ii. verse 3.)

The following synonymes of the three families may be serviceably introduced, so as to show, at a glance, the views which have been entertained respecting their nomenclature.

ACHETIDÆ *Leach.* Gryllus Acheta *Linn.* Acheta *Fabr.* Gryllides *Latr.*

GRYLLIDÆ *Leach.* Gryllus Tettigonia *Linn.* Locusta *Fabr.* Locustariæ *Latr.*

LOCUSTIDÆ *Leach.* Gryllus Locusta *Linn.* Gryllus *Fabr.* Acridi *Latr.*

The Linnæan name Bulla has been entirely dropped, having been previously employed for a genus of shells; but that of Acrida, and its diminutive Acrydium, have been as much confused in their application as the other Linnæan names; Fabricius, Leach, Stephens, &c., giving the latter to some of the Linnæan Bullæ; Latreille to the true locusts; and Kirby to the grasshoppers with long antennæ. I have shown above that it ought either to be dropped, or employed instead of the modern generic name Truxalis. The Linnæan Bullæ will still, however, require a different name; and, in order to avoid all further confusion, it will be evidently most advisable to employ Latreille's name Tetrix for some of them, instead of Acrydium, and that of Pneumora for others.

The first of these three families, ACHETIDÆ *, comprises the insects ordinarily called crickets † (*fig.* 54. 1. Acheta domestica ♀.,

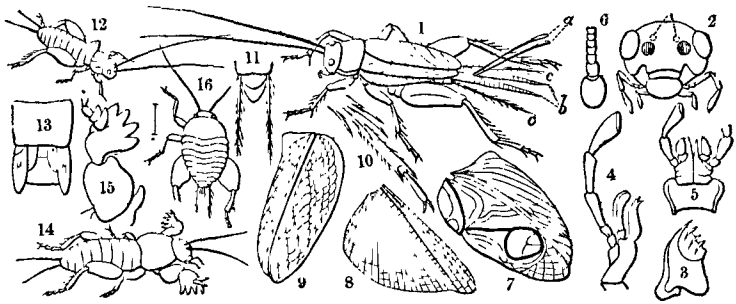
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* BIBLIOGR. REFER. TO THE ACHETIDÆ.

Serville. Ann. Sc. Nat. xxii.
Bosc, in Actes Soc. d'Hist. Nat. Paris, fol. t. i. (Acheta sylvestris).
Say, in Journ. Acad. Scienc. of Philadelphia, t. iv. (Tridact. apicialis).
Foudras. Obs. sur le Tridactyle Panaché, Lyon, 1829.

† The English name cricket, and the French name cri-cri, given to these insects, is an imitation of the sound which they produce. It is surprising, therefore, that in French works which furnish us with the latter name, we should find the French synonymous name criquet given to a distinct family, namely, that of the migratory locusts.

Fig. 54.



the female common cricket; *fig.* 54. 2—13., details of this species), and is distinguished by the great length and slenderness of the antennæ (*fig.* 54. 6., base of antennæ), which often exceed that of the entire body; the horizontal position of the wings and wing-covers when at rest, the former being of large size, and, when folded up, forming a pair of long and slender filaments, often extending far beyond the extremity of the body (*fig.* 54. 1. bb.), and the latter being, in the males, furnished at the base with a large talc-like spot; the body is robust, but depressed above; the eyes large and round; the ocelli* two, in some species; the jaws strong, with several acute transverse teeth (*fig.* 54. 3.); the maxillæ slender, with two acute terminal teeth; the outer lobe (galea) is concave at the tip (for the

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Newman. Entom. Mag. No. 7. (Ripipteryx).
Afzelius and *Brannius.* Achetæ Guineenses. 4to. Upsal, 1804.
Savigny. Descript. de l'Egypte.
Gray, in Griffith, Anim. King. pl. 131. (Cylindrodes).—Ditto, in Mag. Nat. Hist. new series, No. 3.
Ocksay, in Nova Act. Cæs. Nat. Curios. t. xiii. and xvi.
Jacobæus. Anat. Gryllotalpa, Act. Hafn. vol. iv.
Cuvier. Anat. — Ditto (Maulwurf. grille), Mém. Soc. Hist. Nat. an. 7. t. iv.
Kidd. Anat. Gryllotalpa, Phil. Mag. 1825.
Van Der Hoeven. Ditto. Bijdragen Naturk. Wetensch. tom. v.
Annal. Gén. Sc. Physic. Bruxell. t. vi.
De Geer, Fabricius, Stoll, Coquebert, Charpentier (Horæ Ent.), *Panzer, Perty.*

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* There are two very distinct ocelli in both sexes of the mole cricket; in the male field cricket there are two yellow spots behind the base of the antennæ, and a small transverse one between the eyes. In the male of the domestic cricket there are three very indistinct ocelli, which are entirely obsolete in the females.

defence of the internal lobe), and bi-articulated, a distinct articulation (overlooked by Curtis, B. E. pl. 293. f. 4.), existing at the base of the galea; the maxillary palpi are 5-jointed, in the house cricket (*fig.* 54. 4.) as well as the mole-cricket, &c.; although Curtis describes them as only 4-jointed in the former species. The mentum is leathery, and broadest in front; the labium (*fig.* 54. 5.) is quadri-lobed, the two middle lobes being very slender, and the two external ones broader and pilose, articulated both at and near the base: Mr. Curtis represents them as exarticulated in the mole-cricket. Besides these, the lingua is developed, forming "the large, hollow, fleshy appendage" to the labium of Acheta, and the cordate fleshy lobe terminating the labium of the mole-cricket, described by Curtis (*fig.* 54. 2., head of cricket, × indicating the rudimental ocelli). The abdomen is terminated by two long pilose setæ, gradually attenuated to the tip, and inarticulate (*fig.* 54. 1. cc. ♀ and *fig.* 54. 11., extremity of body of the male); and the ovipositor of the female is long and slender, occasionally equalling the entire body in length, the tip being slightly thickened and serrated; the anterior tibiæ have a remarkable talc-like spot near the base; the tarsi are composed of only three joints in the majority of this species: but a more peculiar characteristic of the group, dependent upon their habits, appears to have been overlooked, but by which they are well distinguished from the grasshoppers with long antennæ, to some of which they are very nearly allied. The last-mentioned insects are generally found upon plants; and it is essential for them that their feet should be so organised as to enable them to retain their hold upon the stems or leaves of the vegetables which they frequent: their tarsi are accordingly broad, and the soles fleshy; but in the Achetidæ, which are essentially ground insects, and which run with the greatest agility, fleshy soles to the tarsi would be useless; these parts are, therefore, slender and simple on the underside, the joints of the tarsi in some of the species being spined, thus assisting with the strong tibial spurs in running (*fig.* 54. 10., posterior tarsus, underside *). The caudal setæ (*fig.* 54. 11.) are evidently very sensible, and serve, probably, to give the animal notice of the approach of any annoyance from behind; hence Dr. Kidd terms them caudal antennæ in the mole-cricket (*fig.* 54. 14.). When the insect expands its upper wings, they

* I find that Mr. Patterson has noticed this distinction between the feet of these two families in his interesting little work on the Shakspearean insects.

appear much larger than when it is at rest, the lateral part of each being suddenly deflexed, so as to cover the sides of the body; but as the sides are curved, a narrow membranous piece is inserted at the tip, between the dorsal and lateral pieces, extending to some distance along the wing-covers, and which is concealed when the wings are closed; the veins which traverse the talc-like part of the wing-covers of the males are thick and very irregular in their disposition, and vary in their position in different species. In the males of the house and field-crickets, on the internal margin (*fig.* 54. 7. represents one of the wing-covers of the male, 54. 9. ditto of the female, and 54. 8. one of the wings of the former species), about one-third of its length from the base, a thickened point is observed, from whence several strong veins diverge, forming an angle from this point. The strongest of these veins, which runs towards the base of the left wing-cover is found on the underside to be regularly notched transversely, like a file; when the wing-covers are closed, this oblique bar of the wing-cover lies upon the upper surface of the corresponding part of the right wing-cover; and when a tremulous motion is imparted to the wing-covers, this bar rubs against the corresponding bar of the right wing-cover, and thus produces a vibration, which is communicated to the other parts of the wing-covers; which, being divided into a number of irregular spaces, have each a distinct vibration, and produce a separate sound, which unitedly forms the stridulation or chirrup so well known. I must refer to M. Goureau's elaborate paper upon this subject in the *Annales Soc. Ent. de France*, 1837, p. 31. (and translated in the *Entomological Magazine* for that year), and to a memoir by Latreille in the eighth volume of the *Mémoires du Muséum*, for numerous particulars and details concerning the mode in which the sound is produced in the species above-mentioned, as well as in several other crickets, including the mole-cricket, which, according to Latreille, stridulates only in the evening and night. M. Goureau was able to produce the sound artificially, by rubbing the elytra of the males of this species against each other, although their organs of stridulation are far less strongly marked than in the others; indeed, as the females are destitute of an exserted ovipositor, it is only by a minute inspection of the veins of the wing-covers that the sexes may be distinguished. The females in this family are not able to make a noise, the veins of their wing-covers being more regularly disposed (*fig.* 54. 9.).

The males are, moreover, distinguished by having eight ventral segments in the abdomen, whilst there are only seven in the females.

The house-cricket, Acheta domestica (*fig.* 54. 1. ♀), is too well known to require description. It is an inhabitant of our houses, frequenting the rooms level with the ground, and especially preferring the parts near the fireplace and chimney, into the mortar of which it burrows, even within a few inches of the fiercest fires. In the hot summer weather I have often heard them upon the walls of gardens, as though they found heat enough out of doors; and Mr. Gough mentions the same circumstance, adding that they resume their in-door station about the end of August. On discontinuing the fire during the winter in their haunts, they will become dormant in the crevices of the chimney. (Reeve's *Essay on Torpidity of Animals*, p. 84.); and from the observations of De Geer, it is evident that they are unable to withstand the out-door cold of November. They may, however, be found in their in-door retreats throughout the winter, in different stages of growth at the same period, so that there is evidently no fixed period for their development* (*fig.* 54. 12. larva, and 54. 13. thoracic segments of pupa, showing the rudimental wings and wing-covers.) They are nocturnal creatures, coming out of their burrows in the twilight, at which period they seek their chief nourishment, consisting, according to White of Selborne, of crumbs of bread, the scumming of pots, yeast, and any other household matters; they are also very fond of moisture, being often found drowned in pans of water, milk, broth, &c.; sometimes they abound to such a degree as to be a perfect nuisance, flying into the candles, and dashing into people's faces, according to White. I have observed them suddenly to disappear almost entirely from places previously swarming with them. It is said that these insects destroy the cockroach, and that, in their turn, they are attacked by the field-cricket. They are easily destroyed by placing phials half filled with beer, or any liquid, in their haunts, into which they will crowd till they are full, likewise by pills made of arsenic and flour, mixed with the root of Daucus. Linnæus (*Lapland Tour*, vol. i. p. 254.) says that grated carrots mixed with arsenic, are eaten greedily by crickets, which infallibly poisons them. Superstition has been singularly and most inconsistently brought into action in respect to this insect: even at the present day its chir-

* The habits of this domestic insect have evidently undergone great modifications in consequence of its connection with man.

ruping is in some parts of the country deemed a propitious omen, whilst in others it is regarded as a sign of ill-luck. The house-cricket forms the subject of White's 89th letter.

The field-cricket, Acheta campestris, is larger and much rarer than A. domestica, and of a black colour, with the base of the wing-covers yellow. It is an out-of-doors creature, frequenting hot sandy districts, where it forms its burrows at the side of foot-paths, &c., in situations exposed to the sun, which are of considerable depth (being from six to twelve inches deep, and formed by the assistance of the strong toothed jaws of the insect), and at the mouth of which it sits for the purpose of seizing its prey, which according to Latreille and Goureau, consists of other insects *; indeed, these authors tell us that the children in France capture it by introducing an ant, tied to the end of a string, into its burrow. Pliny, indeed, states that it may be captured by merely introducing a straw into its burrow, whence the proverb *stultior Gryllo* has its origin. The stridulation of this species is much louder than that of the preceding. They are exceedingly timid, and retreat to the bottom of their burrows on the least noise. They form several regularly beaten tracks leading to the mouth of their burrows. The female deposits her eggs in the ground, the number deposited by each being about 300; one, however, kept in captivity by M. Goureau, only deposited four eggs: these are attached together, and glued to the ground, by a gummy matter secreted by the female. The larvæ are hatched at the end of July, and immediately form burrows. In certain seasons these young crickets assemble together and quit their retreats in the twilight, especially after tempests, probably in search of new abodes. The short leaps which they execute give them a great resemblance to young toads, and it has been suggested by M. Goureau that these insects have been mistaken, under such circumstances, for a swarm of young toads supposed to have fallen from the clouds during storms; of which various accounts have from time to time been published. During the winter these young larvæ remain in their holes, which are ordinarily protected by the stone beneath which they are made. On the arrival of fine weather in the following year, they quit their retreats, and seek a more congenial spot, where they make a fresh

* Gilbert White, however, says (letter 88.), "of such herbs as grow before the mouths of their burrows, they eat indiscriminately." He likewise kept them in paper cages, supplying them with plants moistened with water, "but if the plants are not wetted, the insects will die."

burrow. In their larva and pupa state they are active, and resemble the imago except in the want of wings, and, of course, in being unable to stridulate. On arriving at the perfect state, the male takes up his abode at the mouth of the burrow, and commences his strong and rapid chirp, of which the object is evidently to attract the female. On confining two males together, they will fight until one is destroyed and then devoured. It is in the months of May, June, and July, that they are to be found in the perfect state. Rösel (*Ins. Belust. Locust*, tab. xiii.) and Frisch (vol. i. pl. 1.) have given complete series of figures representing the growth of this insect.

A few lines from a delightful sonnet by Leigh Hunt, addressed to the two preceding species, will not be deemed out of place: —

> "Ye sweet and tiny creatures, that belong,
> One to the fields, the other to the hearth,
> Both have your sunshine; both, though small, are strong
> As your clear hearts; and both were sent on earth
> To sing in thoughtful ears this natural song, —
> In doors and out, summer and winter, mirth."

The other British species of the genus, A. sylvestris, is much smaller than the preceding; it was found amongst dead leaves in a gravel-pit near Lyndhurst, and is remarkable for the small size of the wing-covers, and the want of wings, at least in the female.

There is a curious memoir by the Hon. J. Hall (in the *Trans. Lit. and Historical Soc. of Quebec*, vol. i. 1829), concerning the black field-crickets of North America, which are stated to approach the shores of rivers in September, where they deposit an ell-like cocoon six inches long; but I think there must be some error in this statement.

From information given by Smeathmann to Drury, it appears that the children in Africa search for the females of a large species of Acheta, which they roast, and then eat the eggs, which are contained in a kind of bag, with the greatest relish. The various African species (whereof Afzelius describes nine from Guinea) vary greatly in their notes; one small species being by far the most noisy of the whole.

But the most singular species of the family is the mole-cricket (Gryllotalpa vulgaris), one of our largest British species, and which derives its name from the analogy which it affords, both in structure and habits, with the common mole; its fore legs (*fig.* 54. 15.) being rather short, but remarkably strong and broad; the tibiæ being formed into a thick triangular plate, deeply notched on the lower edge, and so constructed as to close upon the femora; the tarsi are also broad, and in-

serted at the end of a canal, in which they are capable of being lodged. With this pair of legs, admirably adapted to the purpose, and pointing somewhat obliquely outwards, like the hands of the mole (*fig.* 54. 14., larva, resembling the perfect insect, except in wanting wings), it burrows under ground like the mole, raising a ridge as it proceeds, but seldom throwing up hillocks; its muscular power being so great that, according to Rösel, it commonly employs a force equal to the counterpoise of two or three pounds. They infest gardens by the sides of canals, and moist meadows, occasioning, according to White, "great damage among the plants and roots, by destroying whole beds of cabbages, young legumes, and flowers." Latreille, indeed, says, "Elle coupe ou détache les racines des plantes, mais moins pour s'en nourrir que pour se faire un passage; car elle vit à ce qu'il parait d'insectes ou de vers;" and M. Leféburier has published a series of observations, with the view of proving that it is upon subterraneous insects, and not upon plants, that the mole-cricket feeds. (*Nouv. Cours d'Agricult.* 2d edit. tom. v. p. 163.)

The observations of M. Turpin, however, certainly prove that these insects are at times herbivorous, although, for want of food, they will destroy and devour each other. (*Revue Agricole*, No. 2. 1829, p. 65.), and Audouin and Brullé, tom. ix. p. 187.) Dr. Kidd, also, states that "the digestive organs of this insect more closely resemble those of a granivorous bird than of any other animal;" and that of all kinds of vegetable food they preferred the potato, while cucumber they hardly touched; but if raw meat were offered to them, they attacked it, in preference to any thing else, with great greediness; and that when kept, even a short time without food, they attacked each other, and the victor devoured the vanquished. He also states that he repeatedly found the horny and indigestible parts of insects within their stomach, upon dissection. (*Phil. Mag.* Dec. 1825, p. 403.) Gould also states that he fed a mole-cricket for several months on ants. They stridulate with a dull, low, jarring note, continued for a long time without interruption, not unlike the chattering of the goat-sucker.

The females deposit their eggs in the ground. White relates that a gardener, on paring off a piece of turf on the side of a canal, exposed one of the nests, which he thus describes: "There were many caverns and winding passages leading to a kind of chamber, neatly smoothed and rounded, and about the size of a moderate snuff-box

Within the secret nursery were deposited near a hundred eggs, of a dirty yellow colour, and enveloped in a tough skin: the eggs lay but shallow, and within the influence of the sun." The ordinary number of eggs, however, is from 200 to 400 (Rösel, Latreille). The young, when hatched, are at first white, and resemble their parents, except in the want of wings; they keep together till after their first moulting, when they disperse, and soon gain their darker colours. It has been stated that they are three years in arriving at the perfect state: remaining during the winter in a state of inactivity. They leap but badly, and to a short distance.

The flight of this insect is denied by some authors (Zetterstedt, Philippi); but, according to White, it is irregular, *cursu undoso*, rising and falling in curves. It has, indeed, been supposed to be the cause of the "Will o' the Wisp;" but Mr. Stephens states that specimens which he kept showed no traces of phosphorescence, whilst the effects of electro-chemical phenomena are sufficient to account for the one in question. The villose coating of the thorax and wing-covers appears to serve to repel the action of water.

The mole-cricket forms the subject of G. White's ninetieth letter. Rösel has also given a complete series of figures in illustration of its growth (*Ins. Belust. Locust*, tab. 14 and 15.). See also the *Mag. of Natural Hist.*, No. 8.; *Gœdart*, No. 119. In Ray's letters there is an account of this insect in ground bordering on the sea, from a Welsh writer Lhwyd, who has given the Welsh names of the insect.

It is a remarkable circumstance in the geographical distribution of insects, that this singularly-formed, and, as we may call it, anomalous genus, is distributed over the globe, North and South America (Perty, *Del. An. art. Bras.*); Java, China (Donovan); New Holland; Guinea (Afzelius), &c.; having species peculiar to each country.

One of the species which inhabits the West Indies (G. didactyla *Latr.*) has committed great ravages upon the young sugar canes in that island, of which an account has been communicated to the Entomological Society, by Mr. Johnstone. (*Trans. Ent. Soc.* vol. ii. p.11. and 31.)

Amongst the exotic insects of this family are to be mentioned a singular species found in Spain and the North of Africa, Acheta umbraculata, in which the head of the male is produced in front into a long membranous appendage, which falls over the face like a veil. (Coqueb. *Ill. Icon.* vol. i. pl. 1.; Griffith, *An. K.* pl. 63. f. 2.)

M. Rambur has figured a new species, having a similar conformation, under the name of Platyblemnus lusitanicus (*Faun. Entomol. Andalus.*)

The Acheta reticulata *Fabr.* (A. longicornis *Afzelius*) is remarkable for the very great length of the antennæ (three inches), and for the total absence of wings, although the wing-covers are of a large size; I possess it from the shores of the river Gambia.

The remarkable species Œcanthus pellucens (*Panzer, F. I. G.* 22. 17.) is distinguished by its delicate form, long slender palpi, and 4-jointed posterior tarsi: it has been given as an indigenous species on the authority of a specimen in the collection of the late Mr. Haworth. Having, however, purchased the insect at his sale, I am able to state that the specimen has been misnamed, being in no manner related to the insect in question. The genus Phalangopsis *Serville* comprises several various American species, remarkable for the great length of the antennæ and legs, which gives them a strong resemblance to spiders. Serville places them amongst the grasshoppers with long antennæ, but Brullé removes them to this family. The singular little insects composing the genus Tridactylus *Oliv.* (Xya *Illiger*), are destitute of posterior tarsi, their place being supplied by long moveable and curved appendages at the tip of the tibiæ; and the antennæ are very short and only 10-jointed. The species are found upon the margins of rivers in the south of Europe, &c., into the fine sand of which they burrow with the assistance of their fore and middle legs (the tibiæ of which are greatly dilated), and of their mandibles, which are admirably adapted for this purpose. The abdomen is furnished in both sexes with four short appendages at the extremity, and the ovipositor of the female is not exserted. They leap to a very great distance, their hind thighs being much incrassated, and the long appendages to the tibiæ assisting materially in their saltatorial motions. M. Foudras* informs us that the food of T. variegatus consists of fine particles of sand, of which the particles are to be observed in their excrement; but it is evident that the small infusory animals which exist in the sand form their real food. The individual of this species figured in Crochard's

* "*Observations sur le Tridactyle Panaché*, Lyon, 1829, 8vo.; also see Charpentier, *Horæ Entomol.*, the great French work on Egypt; Percheron, *Gen. des Ins. Orth.* pl. 1.; Guérin's *Icon. R. An. Ins.* pl. 54.; Dumeril, *Cons. Gen.* pl. 25.; Coquebert, *Iconogr.* pl. 21.; Say, *Journ. Acad. Scienc. Philad.* vol. iv. p. 310.; Audouin and Brullé, vol. ix. p. 198.

edition of the *Règne Animal*, pl. 81. f. 2., is evidently a partially developed imago. My specimens of T. variegatus (received from Messrs. Lefebvre and Audouin) agree with this figure, the wings being very short, and, as described by M. Foudras, quite unfitted for flight; but the ocelli are quite distinct, thus indicating the imago state. In T. paradoxus and T. fasciatus, the wings extend beyond the abdomen. According to M. Goureau, the wing-covers of the males have not an apparatus for stridulating. (*Ann. Soc. Ent. de France*, 1837, p. 44.) Mr. Newman has described a South American insect closely allied to Tridactylus, under the name of Ripipteryx marginatus. (*Ent. Mag.* vol. ii. p. 204.) Mr. Hope, and, I believe, also Mr. Burchell, possess specimens of this remarkable insect.

Another remarkable species, of very minute size, hitherto only found in ants' nests, is the Myrmecophila Acervorum (Panzer, 68. 24. *Blatta Ac.; Sphærium* Charpent. *Horæ Ent.* p. 79.; my *fig.* 54. 16.); the body is destitute of wings and wing-covers, and is nearly globose, with the hind femora remarkably robust, the anal filaments and ovipositor of moderate length; the antennæ very long, and the tarsi 3-jointed. From its remarkable form, Charpentier was induced to consider it as "medium inter Blattas et Achetas constituens genus," although evidently more nearly related to Acheta. See also a Memoir, by Savi, in the tenth volume of the *Biblioteca Italiana*, entitled, "Osservazioni sopra la Blatta Acervorum di Panzer," which he names Gryllus myrmecophilus. It has been taken near Paris, by Audouin; and by Dr. Klug, near Berlin. It has been recently re-figured in the Crochard edition of the *Règne Animal*.

In the first volume of the *Transactions of the Literary and Historical Society of Quebec*, 1829, there is published a memoir by the Hon. J. Hall, on a species of black cricket, which is asserted to approach the shores of rivers, &c., in September, where it deposits its eggs in a cocoon-like mass, six inches long.

The curious Indian species, Schizodactylus (*Brullé*) monstrosus, is the largest insect belonging to the family, and is remarkable for the great length of the wing-covers as well as the wings, which far extend beyond the extremity of the body, and of which the extremities are rolled up in spiral coil when unemployed, the basal part being horizontal, except at the edges; the body is short and thick, terminated by two long and robust filaments; the tarsi are also remarkable, being 4-jointed, the first and terminal joints long, and the second and third

very short, each of the latter having on each side a broad and flattened lobe, in addition to which in the posterior pair the basal joint is dilated on each side into a triangular plate. According to M. Westermann, this curious insect burrows into the banks of rivers, forming cells three feet deep, in which it remains during the day, flying only by night (*Silb. Rev. Ent.* No. 3.). Fichtel, also, informed Donovan that it resided under-ground like Acheta campestris; on this account, as well as from the general structure of the body, I retain this insect in this family, although M. Brullé, chiefly from the 4-jointed tarsi, has removed it to the Gryllidæ of *Leach*; from which, as well as from the majority of the Achetidæ, it further differs in having the anterior tibiæ not furnished with an oval talc-like plate near the base.

A very curious insect has recently been brought from Melville Island, nearly allied to the mole cricket in the structure of its fore-legs, but which is long and perfectly cylindrical; the legs, which are very short and broad, being lodged in cavities at the sides of the body. It is thus admirably adapted for its mode of life, as it burrows into wood. It is figured, with numerous details, in Griffith's *Animal Kingdom, Ins.* pl. 131., and described by G. R. Gray in the *Mag. Nat. Hist.* N. S. vol. i. p. 142., under the name of Cylindrodes Campbellii.

I possess several very curious minute species belonging to this family, which singularly represent coleopterous insects. Of these a Brazilian species has all the appearance, and even colours of a Cicindela, whilst a small Mauritian species has the wing-covers thick and glossy, oval, convex, and meeting with a straight suture, exactly like elytra.

The second family of the saltatorial Orthoptera, GRYLLIDÆ* *Leach*, (Locustariæ *Latreille*,) corresponding with the Linnæan section

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* BIBLIOG. REFER. TO THE GRYLLIDÆ.

Serville, in Ann. Sc. Nat. t. xxii.

Audouin and *Brullé*. Hist. Nat. Ins. tom. ix.

Lichtenstein, in Trans. Linn. Soc. Lond. t. iv. (On the eye-like spot of the wings of the males.)

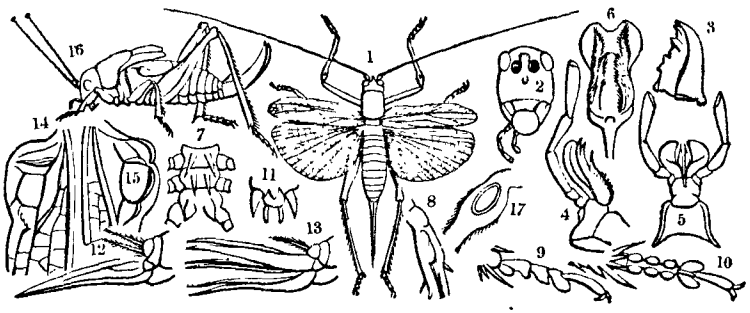
Thunberg. (Piliger), Ins. Hemelytr. 3 Genera Illustr. 1822.

Guérin. Voyage Duperrey.—Ditto. Voyage de Coquille.—Ditto. Voy. Belanger.

Boisduval. Voyage de l'Astrolabe.

Donovan. Naturalists' Repository. Insects of India, and Insects of China.

Fig. 55.



Gryllus Tettigonia, agrees with the preceding family in the great length and slenderness of the antennæ, the exserted ovipositor of the females (*fig.* 55. 1. Meconema varia ♀), and the talc-like spot at the base of the wing-covers of the males. It is, however, distinguished by having the wings and wing-covers disposed, when at rest, like a slanting roof; the tarsi also are 4-jointed. The mandibles are less strongly toothed than those of the Achetidæ; and the ovipositor is generally compressed and sabre-shaped.

The body of these insects is far less robust than that of the true locusts, the legs and antennæ being very long and slender, the wings very large and delicate, and the wing-covers often extending far beyond the extremity of the abdomen, which is liable to shrink on being dried, so that it is serviceable to introduce cotton into the interior, to prevent this from taking place. The head (*fig.* 55. 2. head of

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Kirby, in Zool. Journ. vol. ii. (Scaphura.)
Westwood, in Zool. Journ. vol. v. (Scaphura.)—Ditto, No. 20. (Strongyloderus.)
Guérin and *Percheron*. Genera des Insectes. (Scaphura.)
Dryander. Cat. Libr. Banks, sub voce Acheta.
Charpentier. Horæ Entomologicæ.
Lefebvre, in Guérin's Mag. Zool. vol. i.
Brullé. Exped. Scient. de Morée.
Fischer, in Ann. Soc. Ent. de France, vol. ii. (Bradyporus, &c.) — Ditto. Notice sur le G. Tettigopsis, 4to. Mosc. 1830.
Rambur. Faune de l'Andalousie, No. 2.
Marschall, in Annal. Wiener Mus. der Naturg. vol. i. (1836.)
MacLeay. App. King's Voyage.
Ocksay, in Nova Act. Cæs. Nat. Curios. t. xiii. and t. xvi. Actes Soc. d'Hist. Nat. Paris, 1792.
Fuessly, *Drury*, *Perty* (Del. An. art. Bra.), *Fabricius*, *Stoll*, *Philippi*, &c.

Gryllus viridissimus; *fig.* 55. 3—13. details of the same insect) is short and vertical, but occasionally acuminated in front (as in the genus Conocephalus). The upper lip is rounded and entire, the palpi of moderate length, with the basal joints short; the lower lip is composed of four divisions, of which the lateral ones are by far the largest. (*Fig.* 55. 3. represents one of the mandibles; 55. 4. maxilla; 55. 5. labrum; and 55. 6. internal lingua of G. viridissimus.)

The anterior tibiæ are somewhat dilated at the base, where there is an oval aperture, closed on each side by a talc-like plate * (*fig.* 55. 17. tibia of Scaphura); and which exists in both sexes, so that it is not connected with the powers of stridulation. The third joint of the tarsi is ordinarily dilated, so as to appear bilobed, and the basal joint of the posterior tarsi is often lobed on each side. On inspecting the tarsus on the underside, the basal joint exhibits a transverse impression, as though indicating the presence of two joints soldered together (*fig.* 55. 9. hind tarsus laterally; 55. 10. ditto, seen beneath.) The three thoracic sternums, or one of them at least, are provided with corneous points, varying in the different species (*fig.* 55. 7.), upon which character Serville has established some of his genera. Brullé, however, denies its importance; and I cannot but agree with him, at least to a certain extent.

The wing-covers of the males are furnished at the base, near the suture, with a round talc-like plate †, surrounded by strong ridge-like veins, one on the underside, towards the internal angle of the left-hand wing-cover, being stronger than the rest, and serving as a bar to produce the sound upon rubbing the two wing-covers sharply over each other. The two plates are not symmetrical (*fig.* 55. 14. sutural portion of the base of the left-hand; 55. 15. ditto, of the right-hand wing-cover of G. griseus), and the insect would remain mute, were it not to fold its wings in the ordinary manner, the left cover being generally laid over that on the right-hand side. These organs, and

* In some species the talc-like plate is less distinctly visible, being partially covered over by an operculum composed of the integument of the limb itself (*fig.* 55. 8. base of tibia of G. viridissimus.)

† These eye-like spots were first noticed by Lichtenstein, as indicating the male sex, in a memoir published in the fourth volume of the *Linnæan Transactions*. The Rev. L. Guilding has also described them in the fifteenth volume of the same *Transactions*, and his figures have been published by Donovan in the *Naturalists' Repository*, pl. 122, 123., representing Gryllus camellifolia *Fab.*, a species the stridulation of which is so loud as to be heard at the distance of a mile.

the sounds which they produce, vary in the different genera; and although the males alone are ordinarily provided with them, both sexes in the genus Ephippiger *Latr.* (in which the wings are wanting, and the wing-covers are very short) are provided with them, and consequently able to produce a sound (*Goureau, loc. cit. supra.*)

Sometimes this talc-like plate exists only in one of the wing-covers. In some of the species having the wing-covers of so small a size as to be nearly rudimental, the posterior part of the prothorax is elevated into a kind of dome over the wing-covers, and which has probably the effect of increasing the sound; this is the case with the Ephippiger vitium *, a species which I found amongst the vines on the banks of the Rhine. The object of the stridulation of these insects is, the calling of the female; and one of these insects has on that account afforded to Brunelli an opportunity of making several curious observations on the powers of hearing possessed by insects. (*Lehmann, De Sensibus externis Ins.* p. 23.) The song of these insects (especially that of G. viridissimus *Linn.*) is kept up till late in the evening.

> "So chirps the grasshopper one good-night carol more;
> He is an evening reveller, who makes
> His life an infancy, and sings his fill." — *Childe Harold.*

The ovipositor (*fig.* 55. 12. ovipositor of G. viridissimus; *fig.* 55. 13. the same, with the parts separated) is composed of several flattened plates of variable form and length, of which the insides are applied against each other when at rest, but which the insect has the power of opening, so as to admit the passage of an egg between them. This apparatus is thrust to a considerable depth into the ground, when the female deposits several eggs, and then proceeds to another spot to repeat the operation. Both sexes are furnished also with two short inarticulated processes at the extremity of the body; besides which, the terminal ventral segment in the males is produced into a corneous plate or furcate appendage, provided with projections, and varying in the different species (*fig.* 55. 11. extremity of abdomen of male G. viridissimus.) These insects are more commonly found upon the branches of trees and plants than the Achetidæ and Locustidæ, feeding upon the leaves. They seem, however, to prefer damp situations. Decticus griseus, for instance, and Xiphidion fuscum

* Baron Walckenaer has considered it probable that this insect was the Gaza in the Chaldæan version of the prophets Joel and Amos. (*Ann. Soc. Ent. de France*, 1836, p. 238.)

abound in boggy places among the long grass and rushes at the back of the Isle of Wight. The former species is excedingly wary, running down to the roots of rushes on the least alarm. As they do not, however, assemble in swarms, nor are so numerous, either in species or individuals as the Locustidæ, they do not become so formidable as those insects; when confined together in a small box they will devour each other; and on one occasion I placed a specimen of the great green species in a box, together with one of its hind legs, which it had accidentally jerked off, and on opening the box the next morning, half of the leg was devoured. De Geer also states, that a specimen of D. verrucivorus which died was eaten by its companions in captivity. These insects are exceedingly timid, ceasing their stridulation on the slightest noise.

The young insects, when hatched, resemble their parents in form as well as activity; they are, however, destitute of wings and wing-covers. Their tarsi consist of the same number of joints as in the imago. In the pupa state (*fig.* 55. 16. pupa of G. griseus with the tips of the antennæ cut off), the organs of flight appear as rudiments upon the back of the second and third segments of the body. Zetterstedt describes the male pupa as having the wing-covers as long as the abdomen (*Orth. Suec.* p. 60.); but there are some species which never acquire the slightest rudiments of wings; they are, nevertheless, able to perpetuate their species, as well as others which only acquire rudimental wing-covers.

These insects are ordinarily of large size, the common great green grasshopper of our country, Phasgonura viridissima (*W.* Gryllus v. *Linn.*), being one of the largest native insects, which is about two inches long, and measures three inches and a half in the expanse of its wings. It is of a fine green colour, with the ovipositor long and straight. The eggs, which were deposited during the preceding autumn, are not hatched until spring; two months after which the insects cast their skin; before which time no sexual difference was to be observed in the young individuals: the ovipositor of the female now appears, and after several additional (two only, according to some authors) moultings the insects arrive at perfection. Rösel has published a complete series of figures relative to this and the following species in their different states. (*Ins. Belust. Grillen.* t. viii.—xi.) The Decticus verrucivorus, a rare British species, is employed by the Swedish peasants to bite the warts on their hands; the black fluid which it

emits from the mouth being supposed to possess the power of making these excrescences vanish.

The elegant green species, Meconema varia (so common upon oaks), is remarkable for the complete absence of any instrument for stridulation in the wing-covers of the males.

The fine green colours of many of these insects fade after death to a dirty yellowish green or grey.

Amongst the exotic species of this family, many present the most singular resemblance to leaves of various plants, whence the specific names of Laurifolia, Lilifolia, Myrtifolia, &c. Some of these species are of very large size, and ornamented with various colours, in which green and greyish are the most prevalent. The Australian genus Prochilus *Brullé* seems to approach the Phasmidæ in the slenderness of the body and hind legs, and the oblong form of the prothorax. The Brazilian Scaphuræ *K.* (Piliger *Thunb.*) are remarkable for their singular antennæ, of which the basal joints are thickly clothed with short hairs. The insects of this genus present a remarkable analogy with the large Brazilian Pompilidæ; and Mr. Swainson has informed me that they are very similar in their motions to these Hymenoptera, shaking their wings and running about quickly. The Australian Acripeza reticulata *Guér.* is distinguished by the short thick body of the female, covered with a pair of swollen wing-covers, but destitute of wings; the males, on the contrary, are of the elongate ordinary form of the family. Some singular species, of large size, inhabitants of the south of Europe and Africa, are distinguished by their constantly apterous condition. Such are the species of Saga, Tettigopsis, Bradypus, &c.; some of these are the most hideous-looking insects. But the Australian genus Anostostoma *G. R. Gray* (*Mag. Nat. Hist.* vol. i. p. 143.), in the immensely developed mouth, armed with enormous mandibles, certainly far exceeds the rest in this respect. There are some singular allied species figured by Herbst (*Naturf. Freund. Berl. Neue Schr.* tom. iv.). Hyperhomala virescens *Boisd.*, from New Guinea, is distinguished by the prothorax* extending completely over the abdomen like a pair of elytra. Strongyloderus serraticollis *Westw.*, from India, is also remarkable for the large size of its prothorax, which is dilated at the sides, and rounded; whilst Condylodera tricondyloides

* Serville erroneously states that it is the metathorax which is thus extended. (See my Memoir on the Thorax of Insects, in *Entom. Mag.* No. 25.)

Westw., from Java, in the elongated constricted prothorax and fine blue colours, exactly imitates the Cicindelideous genus Tricondyla. Stoll has figured a singular species, apparently belonging to this family, under the name of the "Grillon aquatique cornu" (Henicus Stollii, *G. R. Gray*); but it is quite evident, from the saltatorial structure of the legs, and the impossibility of the insect executing a leap under water, from the natural resistance of the element, that there must be a mistake in the statement that it is aquatic in its habits.

The third and last family of the saltatorial Orthoptera comprises the various species of migratory locusts, LOCUSTIDÆ * *Leach* (Acrydii *Latr.*), consisting of those species of the section of which the females are destitute of an exserted ovipositor (*fig.* 56. 1. Locusta flavipes) with the tegmina and wings deflexed, and the antennæ short, filiform, and cylindric; with from twenty to thirty joints (*fig.* 56. 8.), ensiform (*fig.* 56. 19.), or clavate (*fig.* 56. 15.) The tarsi have only three joints (*fig.* 56. 12.), but the basal joint is longer than the others, and

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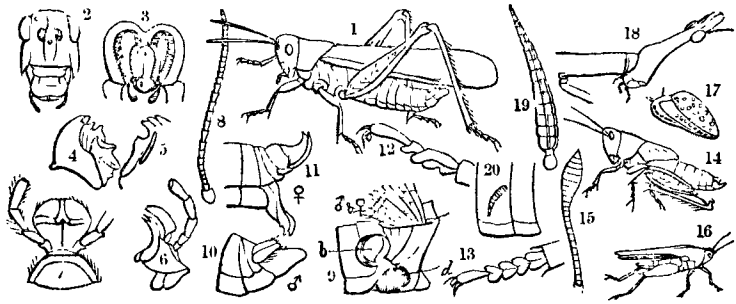
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Stoll, Palisot Beauvois, Coquebert, Perty (Del. An. art. Braz.) *Charpentier* (Horæ Ent.), *Drury, De Geer, Brullé* (Morea), *Schäffer, Herbst, Risel, Griffith* (An. K.).

Fig. 56.



exhibits on the underside two impressions (*fig.* 56. 13.), so that it may be easily perceived that it is composed of three joints soldered together, and the wing-covers are not furnished with the ocellated spot observable in the preceding family, stridulation being produced in a different manner in these insects.

The body of these insects is more robust than in the preceding family, and compressed at the sides, especially in the abdominal part, which causes the wings to assume a deflexed position in repose. The three ocelli are ordinarily distinct, the central one being never obliterated, as in the Gryllidæ (*fig.* 56. 2. head of L. migratoria in front; *fig.* 56. 3—13. details of ditto); the upper lip (*fig.* 56. 3. underside), is notched at the anterior margin, the mandibles are strong and very much toothed (*fig.* 56. 4. 5.); the palpi are short and cylindrical (*fig.* 56. 6. maxilla); the labium is large, but consists of only two lobes (*fig.* 56. 7.).

The females are destitute of an elongated exserted ovipositor, the terminal segments of the body (*fig.* 56. 11.) being furnished with four short conical horny appendages, which represent the parts of the ovipositor of the Gryllidæ. In the males (*fig.* 56. 10.), the two lower appendages are represented by a horny plate. The inferior surface of the abdomen in the males consists of eight, but only of seven segments in the females: the extremity of the body is also furnished with two very short conical filaments.

The stridulating powers of these insects must have attracted the notice of every one who has walked through the fields in the autumn; unlike the insects of the two preceding families, it is owing to the motion of the hind femora, either conjointly or alternately rubbed against the sides of the wing-covers, that the sound is produced, the

insects resting on their four anterior legs during the operation; the veins of the wing-covers being considerably elevated, so as to be easily acted upon by the rugose inner edge of the thigh. Some species, according to Goureau, may be observed to execute this movement without producing any sound perceptible to our ears, but which he thinks may be perceived by their companions.

The pupa of one of these insects is represented in *fig.* 56. 14. Many of the species of this family present on each side of the body, near the base of the abdomen, a large cavity, closed on the inside by a very slender skin of a whitish colour (*fig.* 56. 9. metathorax and basal segment of abdomen, — *a* the femoral cavity, *b* the membrane.) Latreille has described this organ in the eighth volume of the *Mémoires du Mus. d'Hist. Nat.*, and which he (as well as Linnæus, Burmeister, and others) considers must have a certain influence either upon the act of stridulation, or during flight. M. Goureau, however, considers that the sound is alone produced by the friction of the thighs and wing-covers. (*Ann. Soc. Ent. de France*, 1837, p. 57.) These cavities exist also, but less perfectly developed, in the larva and pupa states, according to this author, who entertains the opinion that they may possibly be the analogues of ears. The genus Tetrix (*fig.* 56. 16.) does not appear to be musical; neither are the females of the Locustidæ, although they may be occasionally perceived rubbing their thighs and wing-covers together. The females envelope their eggs (which, according to Zetterstedt, are three lines long in L. migratoria) with a glutinous secretion, so as to form a cocoon-shaped mass, which they are said by Latreille to attach to various plants. Solier, however, states, that they are deposited in horizontal tubes of earth, coated with a glutinous secretion, terminating in a cell an inch and a half deep; each tube holding from fifty to sixty eggs, or from eighty to a hundred, according to Smernove, in *Linn. Trans.* vol. xv. p. 507. In the south of Europe rewards are offered for the collection both of the eggs and perfect insects — half a franc being paid for a kilogramme of the former, and a quarter of a franc for the same measure of the latter; at this rate the city of Marseilles paid, in 1613, 20,000, and Arles 25,000 francs; in 1824, 5542, and in 1825, 6200 francs were paid by Marseilles. (Solier, in *Ann. Soc. Ent. de France*, tom. ii. p. 486.) The Turks also send out bodies of peasants to destroy the locusts; and from a curious Chinese document, published in the

first volume of the *Royal Asiatic Society's Transactions*, it appears to be part of the duty of the provincial governors to see to the destruction of these obnoxious insects, and to erect stations for giving rewards for them. An amusing account is given in the *Penny Magazine*, 1838, of the American mode of destroying the locusts, which occasionally swarm in the United States.

The powers of locomotion possessed by these insects exceed those of the other saltatorial Orthoptera: they leap with greater force, and their flight (at least in the large migratory species) is much more continuous, and far higher than that of the others; their powers of devastation are also far more excessive; for as they are produced in vast numbers, and keep in an imperfect state of society together, they soon destroy the vegetation in the spot where they were produced; whence they take flight in great swarms to adjoining districts, whereby they have obtained the name of migratory locusts. So great indeed is the number of individuals of which one of these swarms is composed that the sky is darkened during their passage, and the spots where they alight almost instantly assume the appearance of a barren wilderness. Even their destruction is, in itself, a fresh source of danger—the air being filled for miles with the putrefying effluvia of their decaying carcases. The species which, in Europe, inflicts the greatest destruction, is the G. migratorius * *Linn.* I must, however, refer to the works of Kirby and Spence, Latreille, &c., for more ample details relative to the periodical appearance of the flights of locusts, which have at various times spread dismay throughout Europe, &c. See also the *Atti de Real Instit. de Napoli*, 1811; Dryander's *Catalogue of the Banksian Library*, art. Locust; Frankland's *Travels to Constantinople*, London, 1829; Shaw's *Travels in Barbary* (1724); Barrow's *Travels in South Africa*, p. 257.; Pallas's *Travels in Russia*, vol. ii. p. 422.; Irby and Mangle's *Travels in Egypt*, p. 443.; Smernove, in *Linn. Trans.* vol. xv. p. 507. In *The Gentleman's Magazine*, it is noticed, that at the end of August, 1742, great damage was done to the pastures,

* It is certain that numerous species have been confounded together under the name of L. migratoria; the true L. migratoria is the species which occurs in central Europe, but the species which devastate the East, Arabia, Barbary, &c. are doubtless distinct. M. Lefebvre was witness to the fall of a swarm of Œdipoda cruciata *Charp.* at Smyrna. (*Ann. Soc. Ent. de France*, 1833, p. 338.) Locusta italica, according to Ionicus, is the only destructive species in Cephalonia.

particularly about Bristol, by swarms of grasshoppers. In 1746 also, our island was visited by a swarm of the migratory Locust; but they perished without propagating. See also Lloyd, on swarms of Locusts which appeared in Wales, in *Philosoph. Trans.* No. 208. Also Willichius, *Dialogus de Locustis*, 8vo. Argent. 1544; Kirchmaier (T.), *De Locustis*, 4to. 2 pl. Wittemberg; Kirchmaier (G. G.), *Epistol. de Locustis Insolitis*, 4to. Wittemb. 1693; Ludolphi, *De Locustis*, fol. 1691, Frankf. on the Maine; (Rappolt E.), *General Contempl., &c.* (3 *Prussian Locusts described*), 4to. Berlin, 1730.

In various countries of Africa and Asia the inhabitants make use of these insects as food, pulling off their wings and legs, and frying them in butter, oil, or (according to Clapperton) pickling them or drying them in a mass; hence the inhabitants of these countries have obtained the name of Acridophagi. The inhabitants of Senegal dry another species (figured by Shaw and Denon), and which they then reduce to powder and use like flour. (Latr. *Règne An.* t. v. p. 187.) Madden also states, that the same process is adopted by the Arabs. (*Travels in Turkey*, vol. ii. p. 31.) See also Hasselquist's dissertation "*An Locustæ ab Arabicis cibi loco adhibeantur*," in *Swedish Trans.* 1752; also, the treatise by Baldanus, *Locustæ Majores quibus Johannes in Deserto vitam tolerasse dicitur* (*Comment. Bonnon.* tom. v.). In an extract from an American paper, in my possession, an account is given of the destruction of the large common American winged grasshopper by ichneumons, which are stated to deposit their eggs in the body of the grasshopper at the period of depositing its eggs; and a correspondent (Ionicus) of *The Entomological Magazine* found a great many large pink eggs, supposed to be those of some parasite, attached to the under wings of Gryllus italicus, in Cephalonia. The British species are of small size (with the exception of one or two of the migratory species of larger size, of which single individuals have occurred at rare intervals): they are, in fact, the well-known grasshoppers, whose chirp is so constantly heard in our meadows in the summer and autumn months: they, however, prefer hot and grassy situations. These seldom attain an inch in length. They light to a very great length, and occasionally assist their escape by taking wing, but only for a short distance. The species of the genus Tetrix *Latreille* (Acrydium *Fabr.*) are remarkable for the greatly developed prothorax, of which the posterior part is extended completely over, and sometimes considerably beyond, the extremity of the

abdomen (*fig.* 56. 16.); the wing-covers (*fig.* 56. 17.) are exceedingly minute, but the wings are of ample size; the species are amongst the smallest of the order, but their specific distinctions are not yet understood; Zetterstedt describing (but with doubts as to their distinctness) eighteen, which Charpentier reduces to two.

I have described a genus, with very singular antennæ, allied to Tetrix, from the Malabar coast, in the *Zool. Journ.* No. 20. (Tripetalocera ferruginea); also another exotic genus, with the prothorax very large, elevated, and the entire insect being so much compressed as not to exceed the thickness of a card, Hymenotes rhombea (Membrans rh. *Fabr.*, and H. triangularis, *Proc. Zool. Soc.* Nov. 14. 1837.).

The exotic species of this family comprise some of the most gigantic, and at the same time, gayest of the insect tribes; Locusta dux being in fact little short of a foot in the expanse of the wings. As the species fly much by day, their posterior wings are beautifully coloured, red and blue, with black spots, being prevalent hues. In some of the exotic species the prothorax is crested, the crest indicating several tranverse impressions, showing the sectional structure of the prothorax.

The genus Truxalis is remarkable for its slender form, the prismatic form of its antennæ (*fig.* 56. 19.), and the elongated pyramidal-shaped head. The genus Proscopia *Klug* comprises various Brazilian species of a long and cylindrical form, which have never been observed otherwise than in an apterous state, with the head (*fig.* 56. 18.) long, the eyes large and prominent, and the antennæ very minute, with not more than six or seven joints (eight, according to Brullé); the legs are long and slender, and scarcely fitted for leaping. Dr. Klug has published a monograph upon this genus, which, in its general form seems to constitute a connecting link between the Locustidæ and the linear Phasmidæ. The species of the African genus, Pneumora, appears to be still less able to leap, the large vesicular bodies of the males, and the slenderness and shortness of the hind legs preventing such an effort. The males are furnished with wings and wing-covers, of the ordinary size; but they are very small in the females, which have the body of the ordinary shape. They are called Blaazops by the Dutch colonists at the Cape, from their bladder-like form. They are silent by day, but make a tremulous and tolerably loud noise by night. (*Sparrman, Voy.* tom. i. p. 312.). The stridulation of this genus is evidently produced in a manner unlike that of the other tribes. On account of the

slenderness of the hind legs, the sides of the abdomen of the males are furnished with an oblique elevated notched ridge (*fig.* 56. 20.), against which the femur acts, whilst the bladder-like abdomen evidently assists in the sound. (See Charpentier in *Silberm. Rev. Ent.* No. 18.)

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